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Vol. LII. JANUARY, 1923 No. 1.

ARCHIVES
OF
OPHTHALMOLOGY

FOUNDED IN 1869 BY HERMAN KNAPP

EDITED BY

ARNOLD KNAPP, NEW YORK
CARL HESS, MUNICH
WARD A. HOLDEN, NEW YORK

SHOULD WE STILL CONSIDER THE OCULAR TENSION AS BEING DUE TO THE AQUEOUS HUMOR? THE OCULAR TENSION AFTER PUNCTURE OF THE ANTERIOR CHAMBER OR PRESSURE ON THE EYEBALL . . . . . A. P. MAGITOT

ISOLATED PARALYSIS OF THE INFERIOR OBLIQUE SEARLE B. MARLOW

FACTORS INFLUENCING THE CHOICE OF METHOD FOR CATARACT EXTRACTION . . . . . DORLAND SMITH

PARALYSIS OF DIVERGENCE WITH REPORT OF THREE CASES DUE TO EPIDEMIC ENCEPHALITIS . . . J. H. DUNNINGTON

BITEMPORAL CONTRACTION OF VISUAL FIELDS IN PREGNANCY C. E. FINLAY

ABIOTROPHY: OPHTHALMOPLEGIA EXTERNA A. W. STIRLING

THE LAW OF ROTATION OF THE ASTIGMATIC AXIS A. W. STIRLING

METASTATIC THYROID TUMOR IN THE ORBIT . ARNOLD KNAPP

(Complete contents inside)

G. P. PUTNAM'S SONS
2 WEST 45TH ST., NEW YORK

PUBLISHED BIMONTHLY SUBSCRIPTION, SIX DOLLARS A YEAR

Entered at the Post-Office, New Rochelle, N. Y., as Second-Class Mail Matter

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About three quarters of the space is devoted to original papers, and the remaining quarter to a systematic report on the progress of ophthalmology, and to reports of societies, book reviews, and miscellaneous notes, all of it original.

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SHOULD WE STILL CONSIDER THE OCULAR TENSION AS BEING DUE TO THE AQUEOUS HUMOR? THE OCULAR TENSION AFTER PUNCTURE OF THE ANTERIOR CHAMBER OR PRESSURE ON THE EYEBALL.[1]

BY DR. A. P. MAGITOT, PARIS.

(With seven illustrations in the text.)

HAVING studied, with Mestrezat, the chemical modifications of the aqueous humor of second formation, I have undertaken on my own behalf a series of researches concerning the ocular tension after puncture of the anterior chamber. This particular point of ocular physiology had not yet been studied fully (Bonnefon) in spite of the interesting data which it could furnish on the liquids and circulation of the eye. The only theory advanced was that the ophthalmotonus reconstituted itself fairly rapidly (in 1 to 2 hours) in man, but that there might be variations due to the conditions of the subject (Wessely-Seidel).

I have made use of both animals and man, as subjects of study. On the former, I registered the modifications of the tension with a manometer; on the latter I was obliged to content myself with the tonometer. What follows will however prove that the effects obtained are comparable in all respects.

[1] Paper read before the Soc. d'ophtalmologie de Paris, March–April, 1922.

So as not to report the detailed account of thirty experiments, I have classified them into three groups each of which represents a definite type:

EXPERIMENT TYPE A.—Chloralosed dog. The needle of the ocular manometer is in the right anterior chamber. The blood pressure is measured from the left carotid (Fig. 1).

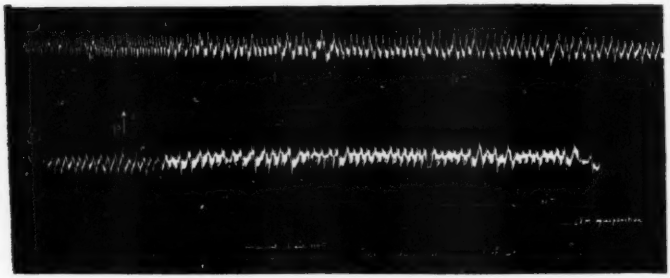

FIG. 1.—Chloralosed Dog. Mercury manometer connected with the R. anterior chamber. Another manometer in connection with the left carotid artery is used to take record of the general blood pressure. The ophthalmotonus was of 30*mm* Hg. After withdrawal of the aqueous (arrow P) it fell to 0, but very soon began to rise. In a few minutes it reached 52*mm* and the descent began slowly. The return to the original figure needed 48 minutes. Total time of the record = 1 hour, 5 minutes.

Three minutes approximately after having introduced the canula needle into the anterior chamber and after having registered the tension, a small needle five tenths of a millimeter is introduced very obliquely into this same anterior chamber and the aqueous humor is slowly extracted. As soon as this needle is withdrawn the ocular tension falls to zero. This state lasts, according to the animal, from 5 to 10 minutes and then the tension slowly rises to 6*mm* and then to 10*mm*. When it reaches the neighborhood of this figure the ophthalmotonus increases rapidly. The initial tension is very rapidly reached and passed. With every movement of expiration a sort of wave of hyperpressure is produced. When it has reached from 40 to 50*mm* Hg the ascensional movement stops, and then after a few minutes it begins to descend fairly rapidly (less rapidly, however, than during its ascent) and finally returns to the original figure.

The whole of this phenomenon does not last more than

half an hour, time being calculated from the moment of puncture.

At this moment then, in most animals, take place several ascensional movements of 5 to 10*mm* Hg, followed by relapse, and then all becomes quiet again after a space of time varying from 40 to 60 minutes (see Fig. 2).

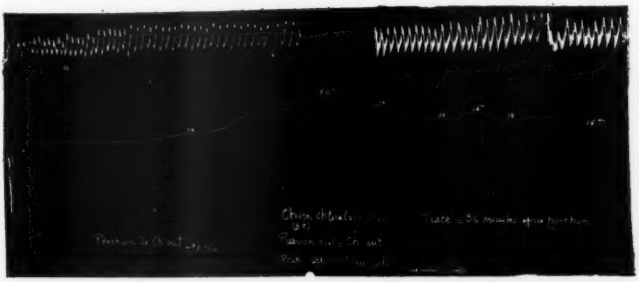

FIG. 2.—Chloralosed Dog. Puncture of the anterior chamber. The lower curve is that of the ocular manometer. After the withdrawal of the aqueous (arrow P) the tension fell to 0. It rose a few minutes after, passed very quickly 20*mm*, 30*mm*, and reached in this case 80*mm* Hg. The descent was nearly as rapid as the ascent. Notice the *oscillations* of the ophthalmotonus before it recovered its original figure 26*mm* Hg. The upper curve is that of the general blood pressure (crural arteric). Time of the record = 34 minutes after puncture of the anterior chamber.

The first type of experiment, illustrated by the record herewith (Fig. 1), draws attention to the fact, that after puncture of the anterior chamber, not only does the ocular tension rise again to its primitive level, but on the contrary it considerably exceeds it. Moreover it must be noted that it does not return to the original figure until it has gone through a fresh series of rises and falls. On the other hand, the carotid record shows that the variations of the arterial pressure, being inexistent, could not explain these oscillations.

EXPERIMENT TYPE B.—The patient is a young man suffering from atrophy of the optic nerve resulting from an old intracranial injury, but whose eyeball is entirely normal. Two drops of holocaine 2% are instilled. The ocular tension taken on both sides is 20*mm* Hg (Schiotz). The anterior chamber of one of the eyes is then punctured and emptied almost without aspiration.

The binocular tension is taken every half-hour. At the end of the first 30 minutes the tension has gone up to *20mm.* At the end of the first hour it has reached *32mm.* After one hour and a half it still remains at this figure. After two hours it has fallen again to *25mm.* It remains at this level for a time and then slowly falls and becomes fixed at *20mm,* six hours after the puncture of the anterior chamber (Fig. 3).

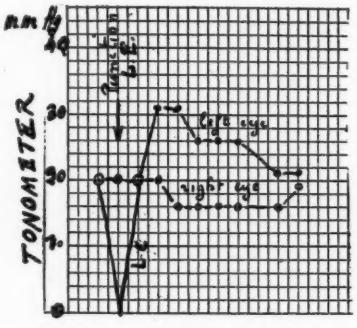

FIG. 3.—Puncture of the anterior chamber on patient aged 21. Ophthalmotonus tested every 30 minutes with Schiotz's tonometer. Comparative record of both eyes.

Variation.—In man as in animals it happens that the original tension is not definitely reached until after one or two rises.

This second type of experiment proves to us that, in man as well as in animals, puncture of the anterior chamber brings about a hypertension, and often a certain instability before reaching again the figure of the other eye which serves as a standard.

The sole difference consists in the fact that the original pressure is more rapidly regained in the dog than in man. We should note also that the oscillations of the ophthalmotonus are ascending not descending; in other words, the tension rises above the starting point several times but does not descend below it any more.

To what may we attribute this phenomenon? We have seen that the modifications of the *general* pressure are not in ques-

tion since in animals the pressure in the carotid remains unchanged. On the other hand there remains the local blood pressure. The following experiment will reply to this.

EXPERIMENT TYPE C.—A dog whose right carotid has been ligatured. The left eye is punctured and in conformity with experiment A, we note a hypertension, oscillations and return to the original figure at the end of one hour.

If the right eye be now punctured, on the side of the ligatured carotid, and the result be observed with the mercury manometer, it is noted that no hypertension takes place. Quite to the contrary the figure given by the ophthalmotonus before puncture is only reached again very slowly and after several hours (Fig. 4).

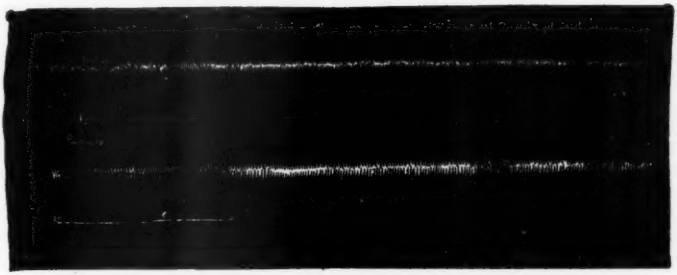

FIG. 4.—Chloralosed Dog. ***Right carotid art. ligatured.*** Ocular manometer connected with the left anterior chamber. Ophthalmotonus = 21*mm* Hg. Puncture and withdrawal of the aqueous humor (arrow P). Ocular tension falls to 0. In the reverse of the records 1 and 2 the ocular tension does not rise quickly, and after 55 minutes it has only reached 16*mm*.

This experiment shows therefore that the local blood pressure is the primordial factor. But in what manner? Is it by transudation of the endocular liquid, or; is it by simple vascular repletion?

For the discussion of this question we possess already several data:

1. The normal ocular tension in a healthy animal is made up of two factors. One belongs rightfully to the eyeball the other is extraneous. It is also a fact that when an animal is killed by bleeding, the ophthalmotonus does not fall to zero but to 10*mm* Hg approximately. It is only after 20 hours that the

tension becomes negative. Independently of all circulation the eyeball possesses therefore a positive pressure of 10*mm*. The surplus is due to local blood pressure. Experiments in perfusion prove this (O. Weiss).

2. The tension of 10*mm* which seems to belong solely to the eyeball is in reality the pressure under which is stored the aqueous humor. It would seem moreover evident that this pressure of 10*mm* is itself a consequence of the local blood pressure. In other words, it is the result of the osmotic pressure.

3. After puncture of the anterior chamber the liquid which fills it again, *is not aqueous humor* but an exudation. It is at the end of 4 hours in man, from 16 to 20 hours in animals, that the intraocular liquid is really once more aqueous humor (Mestrezat and Magitot).

Now, if we consider the hypertension which succeeds puncture of the chamber we notice that it reaches its maximum in the dog a quarter of an hour after the puncture, in a young man one hour after the normal liquid has been withdrawn. At first sight this hypertension would therefore seem to be much more related to the transudation of the exudation than to the regeneration of the normal aqueous humor. If we examine the question more closely, this hypothesis is untenable. The second aqueous humor presents its maximum of albumen towards the third hour in animals, and at the end of 45 minutes in man (Mestrezat and Magitot). On the other hand the hypertension is produced in man one hour after, in animals 10 minutes only after puncture.

Lastly, another consideration; when the blood pressure of the eye is diminished by ligature of the carotid on the same side the phenomenon of hypertension does not take place.

The cause of this hypertonia would therefore be the local pressure, but in what manner?

It is quite evident that in emptying the anterior chamber, we determine a fall of the ophthalmotonus; in fact, the manometer which marked 20 to 25*mm* Hg falls to zero. This depression, even when made slowly, naturally engenders a mechanical dilatation of the capillaries and small arteries whose walls are distended by the blood column which possesses a diastolic pressure of at least 30*mm* Hg, and a systolic pres-

sure of 70*mm*. It is due to this modification that the phenomena of dialysis are modified and that the blood serum passes through the cellular membranes. But *the distended vascular walls react and cause a slight constriction*. It is these repeated efforts, alternately successful and unsuccessful, which are expressed by the hypertension and the very curious oscillations which succeed it. If this hypertension is absent after ligature of the carotid, the cause must be attributed to the fact that the suppression of this vascular trunk diminishes the pressure of the local blood column that is proceeding to the eyeball by the roundabout way of the anastomoses.

AFTER MASSAGE.

The phenomenon of hypertension after puncture of the anterior chamber may be brought about by two methods: prolonged massage of the eyeball, or a pressure of from 200 to 250 grammes applied for at least 5 minutes. (With Bailliart's instrument.)

We have made these experiments not only on the usual laboratory animals (Bonnefon on the rabbit), but above all on *man*. I have chosen among the ten charts obtained two of the most characteristic, although, in reality, all are very similar.

The technic used is as follows: After instillation of holocaine 2% the tension is taken with Schiotz's tonometer in order to make sure that both eyes are the same. A pressure of 250 grammes is then applied with Bailliart's pressure gauge directly on the external side of the sclerotic of one of the eyeballs. This pressure must be continuous and there must be no slipping. Experience has shown me that in spite of this pressure of 250 grammes pain was very slight and the oculo-cardiac reflex extremely silent. For further security a drop of holocaine is let fall from time to time between the eyelids of both sides.

When the pressure gauge is removed, it will be noted that the eye is soft; the anterior chamber slightly diminished in volume and the iris in miosis. Parallelly, every 5 minutes, the ocular tension is rapidly taken on both sides. The results are as follows:

The tension on the eye to which pressure has been applied, rises rapidly. In 5 minutes, sometimes 6 or 7 minutes, it

reaches once more the original figure. In 10 or 12 minutes it rises above it and according to the subject reaches 40 or 50*mm*.

During the following hours, the ophthalmotonus goes down, and, after oscillations even more marked than after the puncture of the anterior chamber, it reaches again the tension of the other eye, whose variations during this time have been insignificant. This state of calm is only reached at the end of 4 or 6 hours (Figs. 5 and 6).

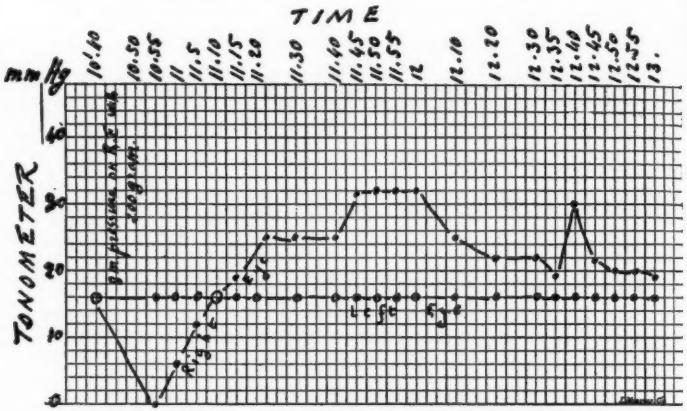

FIG. 5.—Patient age 28. On R. E. pressure during 8 minutes with 200 grammes. Comparative tonometric record of both eyes from 10.40 A.M. to 1 P.M.

This example shows that continuous pressure on the eyeball engenders the same reactional phenomenon as puncture. The explanation of the fall of the ophthalmotonus to zero deserves consideration. Firstly, the negative tension is only obtained by considerable pressure. Moreover the application of this pressure must be sufficiently prolonged. It is easy to conceive that this maneuver drives the blood out of the eyeball. But we know that the disappearance of the blood column still leaves in the eyeball a tension of about 10*mm* Hg. And, after application of pressure, this disappears.

This negative tension of the eyeball indicates plainly to us that the pressure under which is stored up the aqueous humor

has vanished. Partisans of the angle of discharge will have it that the liquid (the anterior chamber is not effaced) is simply due to its passage through the vascular membranes the porosity of which is modified by the traumatism.

I would moreover compare this phenomenon with ophthalmomalacia, this affection, always traumatic, which is due to a

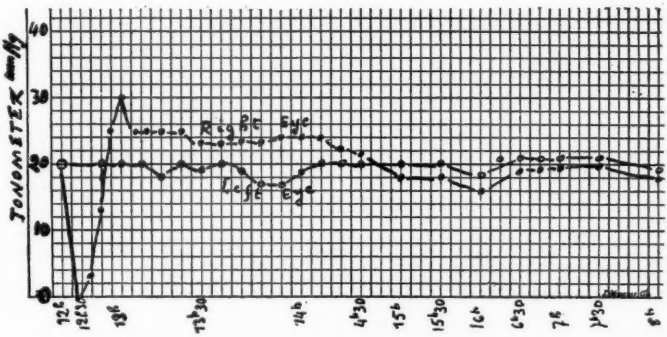

FIG. 6.—Woman age 40. On R. E. 5 minutes pressure with weight 200 grammes. Comparative tonometric record of both eyes from 12 to 6 P.M.

shock on the eyeball. The negative tension persists for a time, more or less long, sometimes for weeks.

I have besides shown, in 1919, that the ocular tension of traumatised eyes presented for a long time oscillations which in a longer period appear to be the exact copy of those I have just described, and which manifest themselves during the hours which succeed puncture of the anterior chamber or a considerable pressure on the eyeball (Magitot).

OCULAR HYPERTENSION BY EXPERIMENTAL IRRITATION OF THE IRIS

The direct intervention of the iris in the modifications of the ocular tension has been considered as possible several times, but no proof of it has ever been given. The experimentation is in fact delicate and necessitates a fairly long apprenticeship, so that authors desirous of showing its rôle have

usually made use of arguments drawn from clinical facts rather than of data supplied exclusively by experiments. However, those who proceeded to researches, by means of manometers, on the ocular tension have in general not been long in observing disconcerting phenomena when the needle introduced into the anterior chamber deviated in certain positions. It is thus that Morax, in the course of his experiments with Girard, remarked that if the point of the small canula needle entered into contact with the iris of a rabbit, the manometrical results of the experiment were absolutely false and he was obliged to have recourse to a fresh animal.

It is a long time ago since I had observed these effects which manifest themselves with much greater amplitude in the cat than in the rabbit and when with Bailliart we were making our researches with pressures exerted on the eyeball, he also was, on several occasions, a witness to this phenomenon.

Since then, I had several times endeavored to provoke it in order to register it on a chart, but it is only recently that I have been able to attain my object.

The following record shows the phenomenon better than any description could do. Registration was obtained by means

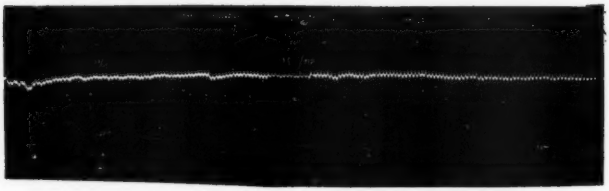

FIG. 7.—Chloralosed Cat. Manometric record of the hypertension by irritation of the iris (lower curve). This hypertension is entirely independent of the general pressure as it appears on the upper curve. Total time = 33 minutes.

of a drum turning slowly, a complete revolution of which takes place in 35 minutes. The subject was a cat anæsthetized by intra-peritoneal chloralose.[1] The upper undulating line is the

[1] Chloralose (and not chloral hydrate) is preferred to other hypnotics, its action on the blood pressure being very slight.

record of the arterial pressure taken at the lower part of the abdominal aorta. The lower line gives the ocular tension taken with a mercury manometer (Fig. 7).

The starting tension was 30*mm* Hg. a somewhat high figure, which, indeed, had drawn my attention to the sensitiveness of the animal and given me the idea of registering the hypertension by irritation. The two arrows indicate the moment when the point of the needle introduced into the anterior chamber was placed in contact with the iris. The ascension of the tension takes place rapidly. In 3 minutes it reached 42*mm*. In 7 minutes 56*mm*. The needle was then removed and the eye left to itself.

Little by little the tension fell and, as can be seen on the chart, it came back to 30*mm* the starting figure. In order to reach this original figure twenty minutes were necessary.

During the whole experiment the blood pressure varied only in insignificant proportions. The hooks registered at the start before the irritation are but the results of a slight agitation of the animal due to the medullary hyper-excitability provoked by the chloralose. But it may be noted that from the moment when the ocular tension began to rise, the aortic pressure no longer varied.

And now what may we conclude from this experiment? It is hardly possible to discuss doctrines. I will confine myself to indicating that the rapidity with which the phenomenon manifests itself is far more in favor of a local hyperæmia than of an increase in secretion of aqueous humor.

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ISOLATED PARALYSIS OF THE INFERIOR OBLIQUE.

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ALTHOUGH a number of cases of isolated paralysis of the inferior oblique have been reported, the infrequency of its occurrence seems to justify the placing upon record of some additional cases, with some references to the literature.

The cases reported by Mauthner (1), Bielschowsky (2), A. Graefe (3), Knabe (4), Fuchs (5), Sachs (6), Gullstrand (7), Terson (8), Delneuville (9), Cohen (10), Cuignet (11), (12), Noyes (13), de Lapersonne (25) and Mooren (14) are referred to by Steindorff (20) in a paper published in 1913 describing also an additional case, an undoubted one following sinus infection.

Mauthner's case was the result of the unintentional cutting of this muscle in the course of an operative procedure upon the face. The case is presented with data corroborating the diagnosis.

Bielschowsky has seen four cases and shows photographs which in addition to other data make the diagnosis clear. Of these one is traumatic in origin, one in all probability due to a gumma of the orbit and in the third there was a syphilitic infection of the central nervous system. Although the ætiology of the 4th case is doubtful a toxic arthritis was present.

A. Graefe describes three cases: one due to a blow in the infraorbital region, one to syphilis, and the third occurred in a 95-year-old man, afflicted with arthritis.

The report of Knabe deals with a case, due to trauma, seen and separately reported also by A. Graefe.

Fuchs and Sachs have separately reported another case due to trauma. The description of this case leaves no doubt as to its genuineness.

Gullstrand describes two cases, one due to trauma, the other apparently congenital, associated with a scrofulous keratitis. Photographs show the characteristic deviation very clearly.

Terson's case followed an injury to the inferior margin of the left orbit. A child, 13 years old while playing was struck in the face and a few minutes later complained of a diplopia, a convergent squint was found to have developed, the left eye lagging upon looking up. Study of the diplopia showed it to be homonymous, the image of the left eye being higher than that of the R. This case may be accepted as authentic.

The photograph shown by Cohen in reporting his case makes the diagnosis certain. It was of congenital origin and possibly associated with paralysis of the superior rectus on the same side.

Cuignet's cases cannot be included in this series. Although they are described at length, they are not clear.

It is obvious from Noyes's own description of his case that the superior rectus was the muscle involved and not the inferior oblique. His diagnosis seems to have depended upon the site of the injury rather than the character of the diplopia.

Mooren's six cases must be rejected for want of sufficient data upon which to judge them.

The case described by de Lapersonne must be accepted. The nature of the paralysis is clearly apparent from his description. It followed a fall from a bicycle which produced a contusion of the left side of the face and hemorrhage into the left maxillary sinus. De Lapersonne attributed it to fracture of the floor of the orbit although both the lacrymal sac and infraorbital nerve were intact.

Delneuville's case is quite similar to de Lapersonne's. The diplopia he describes is characteristic. It followed a fall and was associated with an infection at the lower margin of the orbit.

In addition to these references of Steindorff, cases have been reported by the following: C. S. Bull (15), Little (16), Hulke (17), Dalwig (18), Hertel (19), Inouye (21), Fage (22), Ulbrich (23), and V. Stellwag (24).

Bull states that a careful study was made of his case but gives no data in support of his diagnosis.

The same may be said of the cases of Little, Hulke, and Dalwig.

Hertel's description of his case leaves no doubt as to the diagnosis. It followed a fall and was associated with paralysis of the left arm and left leg.

Inouye's case is a genuine one, although his description is somewhat complicated. It resembles Steindorff's in that it followed infection of the sinuses.

From Fage's description of his case it would appear to be one of paralysis of the superior rectus. He seems to have based his diagnosis upon the location of a blow in the inferior orbital region.

Ulbrich's case may be genuine but there are no data upon which to judge it.

Stellwag Von Carion's description of his case is supported by a diagram of the characteristic diplopia. It came on suddenly following cauterization for trachoma.

The following three cases were seen in the clinic of the Herman Knapp Memorial Eye Hospital.

CASE 1.—*Paralysis Right Inferior Oblique with Paresis Right Superior Rectus (Traumatic).*

Rose F., age 25, came to the clinic June 14, 1920, complaining that her eyes "jumped." About three weeks before while on the way home from work her right eye was accidentally struck by a baseball. When able to open her eye several days later, no diplopia was noted. Upon examination: Vision: R. = $\frac{20}{100}$; L. = $\frac{20}{20}$. Tension normal. L. showed no changes. Anterior chamber of the R. seemed somewhat deeper than L., iris not tremulous. The pupil was dilated (she had been using drops) oval, its margins indented and bound down by some posterior synechia. The lens was clear. There were vitreous opacities blurring the fundus, examination of which revealed a rupture of the choroid extending into the macula.

The motility of the eyes was unimpaired except in the following respects: In looking up and to the right the R. lagged indicating paresis of the R. superior rectus. In looking up and to the L. the R. did not go up at all, indicating complete paralysis of the R. inferior oblique. There was a slight ptosis of the R. upper lid. Diplopia was easily elicited with a red glass in front of one eye. This demonstrated a L. hyperphoria which increased when the patient looked up and to the right, and increased very much more on looking up and to the left.

There was no evidence of fracture of the inferior orbital margin. Immediately after the injury she was unconscious

for a short time, subsequently her lids became swollen and ecchymotic, her eye painful. The remaining ptosis and paresis of the superior rectus may be explained by hemorrhage. The paralysis of the inferior oblique may be explained in this way, but it also seems possible that a blow of sufficient force to knock the patient unconscious, and so directed as to produce a rupture of the choroid might also rupture structures, the function of which is in part to maintain the anteroposterior position of the eye in the orbit.

When last seen 5 months later there was no change except for a developing head-tilt.

CASE 2.—*Paralysis Right Inferior Oblique (Congenital).*

For the opportunity of seeing and reporting this case I am indebted to Dr. J. W. White, in whose private practice it occurred. Claire G., age 7, first seen Nov. 13, 1920. At the age of about 18 months, the mother noted that the L. eye of the child "cocked up." She paid no attention to it thinking that the child was playing. Later it was noticed that the left eye was higher, especially when the child was tired or had been scolded. There was no complaint of diplopia at any time. The child had a normal birth, and has always been well. There are two other healthy children.

Upon examination: Vision: R. = $\bar{c}$ + 1.50 S + 0.75 C 90° $\frac{20}{20}$; L. = $\bar{c}$ + 1.50 S + 0.75 C 90° $\frac{20}{20}$. Both eyes normal. Motility normal except that upon looking up and to the left the R. failed to go up at all.

At 6 M. Exo. = 4△; L. Hyp. = 4△ in the primary position. In eyes up and L. there was a L. Hyp. of 10△ p. p. c. 9.5*cm*. It was noted that the patient could roll her left eye up almost at will. No diplopia could be produced with a red glass. When looking straight ahead the eyes seemed to be perfectly straight. Torsion not looked for.

This case is obviously of congenital origin. The child has been under observation from time to time and seems to be getting on well with glasses correcting her hypermetropia and astigmatism. She has no head-tilt.

CASE 3.—*Probable Paralysis Left Inferior Oblique (Traumatic).*

Gustava K., age 51, came to the clinic Jan. 31, 1921, and was first seen by Dr. J. W. White. About two weeks before coming to the clinic she was struck on the bridge of her nose by some heavy object. A homonymous diplopia with a varying vertical deviation developed which upon first examination was tentatively diagnosed as paresis

of the R. superior oblique. At this time a R. hyperphoria increasing down and to the left was found. Nine days later by the screen and the parallax test a R. hyperphoria increasing up and to the left was found. A third examination eight days later, or 17 days after her first visit (tested with candle, the right eye being covered with a red glass) she showed a vertical diplopia in the right upper quadrant of her field, the red image being lower and to the left of the white, confirming the diagnosis of paresis of the L. inferior oblique. There was no diplopia in other parts of the field. No note was made as to the tilting of the image. Vision: R. = $\frac{20}{40}$ corrected to $\frac{20}{20}$; L. = $\frac{20}{80}$ corrected to $\frac{20}{20}$; J 1 + 2.00 added to her distance glass. There was orthophoria for distance, an exophoria of 4△ at $\frac{1}{3}$ M., p. p. c. 9*cm.* from base line. Torsion not looked for.

This case is obviously one of paresis of the inferior oblique and was transitory in nature.

Among the records of my father, Dr. F. W. Marlow I have found the following cases:

CASE 4.—*Probable Paralysis Left Inferior Oblique.*

Mrs. G. D. W., age 40, presented herself for examination on February 22, 1892, complaining of pain and aching behind her eyes after reading. Examination showed no disease. Vision $\frac{20}{20}$ each with refractive correction. R. hyp. less than 1°, Eso.—2 degrees. Fifteen years after this her refraction had changed; R. hyp. increased to 2 degrees. She was re-examined on several occasions up to April 23, 1917, 25 years after her first visit, and each time the R. hyp. had increased in amount. On April 23, 1917, the R. hyp. was more than 6° in the primary position. Examination in different positions showed the R. hyperphoria to be greatest on looking up and to the right, least down and to the left. She was given prisms correcting her hyperphoria and obtained relief. No torsion noted.

No explanation is offered as to the cause in this case. There was no intercurrent infection or local disease present.

CASE 5.—*Paralysis Left Inferior Oblique.*

Miss M. F. C., age 17, came for examination on December 10, 1892, with the following story. Seven weeks before the left eye and side of her face became swollen. There was headache radiating from forehead to occipital region, and some nausea. The acute symptoms subsided two days later but the headache persisted. Reading made

this worse and she was apt to wake up in the morning with headache.

Examination showed: Vision: R. $\frac{6}{9}$ corrected to $\frac{6}{6}$ R. hyp. $\frac{1}{2}°$ +; L. $\frac{6}{9}$ corrected to $\frac{6}{6}$. Exo. 2°—3°. There is nothing noteworthy in her subsequent history up to Jan. 2, 1920.

At this time her vision was $\frac{6}{6}$ + with proper glasses. There was now L. hyp. 1°, exo. 2°, pres. + 1.50 D. Fundi normal.

April 11, 1921, she returned complaining as follows: About three weeks after her last visit the year before, she began to notice blind spots before her eyes, the L. more than the R., which produced blank spots on a printed page when she read. In the intervals between the appearance of these blank spots her vision remained good, but for the past six weeks this defect had become constant. She has had a diplopia since last summer.

Upon examination: Vision: R. = $\frac{6}{24}$ c̄ her glasses −0.50 s added $\frac{6}{18}$; L. = $\frac{6}{24}$ her glasses unimproved. R. hyp. 9° in the primary position, greatest up and to the right. Ophthalmoscopic examination revealed a group of spots, between the disk and macula in the L. eye. The R. pupil measured *2mm* and reacted well to light; the L. pupil *3.5mm* reacted to light slightly. Tension both eyes normal. The L. eye looked too prominent, measurements with the exophthalmometer were R. *15mm* or less; the left *15mm* or more. Fields normal. No scotomata.

Three months later, July 29, 1921, vision each eye was reduced to $\frac{6}{36}$. There was then some mental deterioration. The R. hyperphoria had increased to 13°. No torsion.

Her general condition varied from time to time, the mental deterioration gradually increasing. She later developed a R. hemiplegia and died on Jan. 13, 1922. No autopsy was obtainable. It is probable that she had a brain tumor although no diagnosis could be definitely made.

CASE 6.—*Paralysis Right Inferior Oblique (Congenital).*

Mr. W. G. C., No. 40—26, seen Nov. 4, 1897, because of nearsightedness. Refraction under scopolamine: R. − 4.00 s.; L. − 2.25 s. c̄ − 0.25 c 180°. Exophoria 1°. L. hyperphoria 2° (cover test). He returned from time to time for re-examination and it is to be noted that more and more hyperphoria became manifest.

July	6, 1899—	L. hyp.	2½°—3°
Feb.	3, 1903—	"	4° +
Nov.	3, 1903—	"	5°
March	30, 1907—	"	4°

Nov.	12, 1908—	L. hyp.	6°
May	15, 1919—	"	8°—10°
May	29, 1919—	"	9° rod, 4° parallax
May	4, 1922—	"	8°

Examination on this latter date yielded the following data:

With binocular fixation there was no limitation in motility except in looking up and to the left when the R. failed to go up normally. With the R. fixing when looking in this direction there was a definite limitation in the excursion of the R. eye and a corresponding excessive excursion of the L. With the L. fixing the R. scarcely moved above the horizontal meridian whereas the movement of the L. was normal.

The screen test demonstrated the following:

Eyes up	and to the	R.	—	Exo.	4°;	L. hyp.	low or o
" "	" " "	L.	—	"	6°;	"	10° —
" down	" " "	R.	—	"	6°;	"	low or o
" "	" " "	L.	—	"	6°;	"	" " "

Diplopia was easily produced with a red glass, there being a characteristic L. hyperphoria which increased rapidly on looking up and to the left. There was binocular single vision on looking down and to the left and right. There was a low left hyperphoria up and to the R. No torsion.

This patient had no head tilt.

This case is undoubtedly of congenital origin and it is particularly interesting to note the manifestation of an increasing amount of hyperphoria over a period of twenty-two years. No explanation is offered for this.

In an unpublished paper, read in Montreal some years ago, Dr. Alexander Duane described five cases. I am indebted to his courtesy for permission to include these.

CASE 7.—*Congenital Paralysis of Right Inferior Oblique Apparent Ptosis (Spastic Closure of Lids) in Abduction.*

"Elsie M., aged 26, a patient of Dr. C. W. Cutler's to whom I (Dr. Duane) am indebted for the privilege of seeing her. Drooping of lid noticed since birth. She says that this has always been more marked in looking to the right and less marked when looking to the left. Also says that she always sees double when trying to look up.

"Width of right palpebral fissure 8 to 9*mm* when she looks straight ahead, 5 to 6*mm* when she looks to the right, 13 to 14*mm* when she looks to the left. The enlargement in looking to the left occurs both in convergent and in parallel

movements. No change in width of fissure produced by movements of the jaw. Width of left fissure 13*mm* not changing in right or left movements of the eye. Pupils equal and reactions normal; no alteration in size produced by looking to the right or left.

"For distance exophoria 5°—7° with binocular fixation; no hyperphoria. For near sometimes binocular fixation down 3 or 4 inches (with exophoria of 12° or more), sometimes alternating divergent squint. Movements of left eye free in all directions. Movements of right eye up and to the right normal, up and to the left much restricted (both in binocular vision and when left eye is covered.) Otherwise movements normal. With fixation-object at three feet vertical (left) diplopia (i.e., diplopia with the image of the left eye below) increasing fast as she looks up and to the left (to 6 or 12 inches); much less when she looks straight up. When she looks up and to the right, little vertical marked and increasing crossed diplopia. No retraction movements of eyes. No torsion of Maddox-rod clinometer in right eye even when eye is directed upward.

"Repeated tests always give the same results. Interior normal. Vision $\frac{10}{10}$ each."

CASE 8.—*Paresis Right Inferior Oblique.*

"Charles R. H., age 24, left hyperphoria 1° increasing after the use of prisms to 3°. With test-object at three feet, single vision everywhere in lower field, crossed diplopia in upper field.

"When he looks up and to the right no vertical diplopia; when he looks up and to the left increasing vertical (left) diplopia (corrected by a 7° prism). Linear separation of double images 2 or 3 inches. Although the diplopia is thus but slight in amount it is present over nearly the whole upper field. Cf. case 8. Extorsion of right eye by Maddox-rod clinometer at times 0°, at times 2° to 5°.

"Prisms correcting 2° of left hyperphoria relieved his persistent headaches, and combined with glasses correcting a slight hyperopic astigmatism, were worn with comfort."

CASE 9.—*Probable Paralysis of Right Inferior Oblique (Traumatic) With Spasm (Contracture) of Right Superior Oblique.*

"Theresa J., aged 49. At age of 12 fell down a hatch on shipboard and injured her eye. Ship's doctor removed a splinter of wood from the eye or thereabouts. Vision poor in right eye ever since.

"Right divergent squint with marked amblyopia (V. = about $\frac{1}{20}$). Movement of eye inward deficient by 2—3*mm.*

Movement of eye up and out fair, and straight up pretty good. When she looks up and to the left, right eye moves in part of the way then drops rather sharply to the horizontal plane. Movement of right downward normal or excessive. When she looks down and to the left, right eye shoots below level of left and then diverges so as to stand in middle line and point far down.

"No scar or other evidences of injury. Right interior normal, even in extreme periphery of fundus."

CASE 10.—*Paresis Right Inferior Oblique.*

"Mrs. C. LeB., age 43. Headaches and vertigo but never spontaneous diplopia. Repeated tests at different times during two years show consistently the following:

"(a) Left hyperphoria of less than 1° when eyes are directed at distance;

"(b) Limitation of movement of right eye up and to the left;

"(c) With test-object at three feet vertical (left) diplopia occupying a part or the whole of the left upper quadrant and sometimes encroaching far beyond this into the right upper and left lower quadrants. Diplopia only slight in amount (double images never more than 4 inches apart and never requiring more than 10° prism to unite them), but is insuperable and always covers a relatively large area of the field. It varies considerably from time to time and even during the course of a single examination as if the muscle got tired and allowed the eye to sag.

"(d) Sometimes there is no lateral diplopia in upper field, sometimes a slight homonymous diplopia. The tendency to homonymous diplopia is less in looking up than in looking down. No cause can be assigned for the paresis.

"(e) Right eye with Maddox-rod clinometer or with candle shows either no torsion or an extorsion. (!)"

To these cases may be added one which Dr. Duane is able to report through the kindness of Dr. C. E. Finlay of Havana, in whose practice it occurred.

CASE 11.—*Paralysis of Right Inferior Oblique.*

"Lady, 28 years of age, unmarried, suffering from displacement of the kidney with frequent attacks of biliary colic. Is taking and has taken much morphine. Diphtheria two years before. Headaches on reading.

"In the primary position sometimes diplopia, sometimes single vision. In upper field typical diplopia, *i.e.*, in looking up and to the left marked vertical (left) diplopia with slight

homonymous diplopia. In looking up and to the right slight vertical and increasing homonymous diplopia with marked right-angled tilting of right eye image. Line of separation between fields of single and of double vision runs obliquely down and to the left.

"Under rest and tonics improved rapidly and diplopia disappeared. Trouble subsequently recurred as a result of using the eyes too much for near work. Under same treatment perfect recovery."

The ætiology of isolated paralysis of the inferior oblique muscle as reported by various observers, including the cases added here, may be summarized as follows:

Trauma in 13 cases.

Congenital origin in all probability in 5 cases.

Syphilis in 2 cases.

In 6 cases the ætiology is uncertain.

In a personal communication Dr. Duane tells me that he has seen 3 cases of well-marked paralysis and one of paresis in addition to those quoted. Only one of these was due to trauma. Tenotomy of this muscle, as described by Duane, must not be forgotten as a cause of this condition.

While trauma appears to be the most frequent ætiological factor, the fact that more than half the cases here cited have some other ætiology, makes it evident that there are many exceptions to this rule. It is this belief, no doubt, which misled Noyes for example, in spite of the fact that the complete description he gives, makes it clear that the superior rectus was the muscle paralyzed. The same may be said of Fage's case.

Implication of the inferior oblique in partial paralysis of the 3rd nerve is fairly common. It may be the first muscle to become affected and also the last to recover. The following case illustrates this latter possibility and shows how with no previous *knowledge* of the history the true ætiology may be so obscured that a diagnosis of isolated paralysis of the inferior oblique would be made.

Mr. Geo. P., first seen by Dr. F. W. Marlow, Jan. 8, 1892. He came with asthenopic symptoms and was given glasses correcting his myopia and astigmatism. He had no muscle imbalance at this time but on subsequent examinations a R. hyperphoria of 2° to 5° developed. On June 6, 1919, he

presented himself for examination with the following story: Six months ago, Jan. 2, 1919, he woke with "paralysis of his L. eye," which had closed by night. He was in Minnesota when this occurred and saw an ophthalmologist there. Fourteen years ago he had a luetic infection for which he received treatment. A Wassermann test made 10 years ago was negative. Since the onset of his present trouble, however, he has had eight salvarsan injections, his Wassermann on June 4th, 2 days before examination being negative. Although his left upper lid has been normal for the past month, a diplopia in the upper part of his field has persisted.

Examination showed: Vision $\frac{6}{6}$ each eye, refraction corrected. The R. pupil was small reacting to light and accommodation. The L. pupil larger than the R. reacted to accommodation but its reaction to light was defective. With the Maddox-rod he had a R. hyperphoria greatest up and to the R. In the primary position with the light 6 M. distant it measured 30°. He was given a 5°, prism base down over the R. eye, a 6° prism base up over the L. for temporary wear. This gave him relief and increased greatly his field of single vision. Later the prisms were changed to R. 7° down, L. 6° up with which he had no diplopia with a red glass over one eye except when he looked up and to the right.

Associated with paralysis of this muscle paresis of the superior rectus has been noted in the same eye in a few instances. Cohen's case, Case (1) of this series and some others are instances of this sort. It brings up the question as to how frequently this happens and makes it advisable to look carefully for some underaction at any rate of the superior rectus on the same side.

Head tilting has not been a marked feature in any of these cases, nor has it been mentioned in the literature. In the cases reported here head tilting has been noted in one case only, in which the vision of the paralyzed eye was defective.

Torsion cannot be said to be an important feature in this condition. It was present in two of Dr. Duane's cases, absent in two; not recorded in one. In my father's cases no torsion is recorded. It may be assumed to have been absent for the hyperphoria has been tested by means of the Maddox-rod in every case and if present would probably have been noted. In the three cases seen at the Herman Knapp Memorial Eye Hospital it was not looked for. Furthermore, Dr. Duane tells

me that the absence or low degree of torsion is particularly noteworthy in those cases in which this muscle has been tenotomized.

The treatment depends naturally upon the degree of annoyance from which the patient suffers. In some cases no treatment other than the incidental correction of whatever ametropia may be present is necessary. Apparently, they get on very comfortably, no doubt due to the fact that this muscle is fundamentally an elevator and consequently is not called upon to function as frequently as is a depressor. This can be readily understood when it is realized that there is no vertical deviation necessarily manifest in the primary position and if present may be of low degree. Prisms correcting all or part of the manifest hyperphoria present in the primary position afford satisfactory relief in many cases.

Operative treatment is recommended by Fuchs and Sachs who tenotomized the contra lateral superior rectus muscle with a good result in their case. This appears to be a logical procedure for if the inferior oblique muscle can be tenotomized with benefit in cases of paralysis of the superior rectus, tenotomy of the contra lateral superior rectus ought to be a favorable procedure in paralysis of the inferior oblique. Furthermore, it seems reasonable that those cases of hyperphoria which have been benefited by tenotomy of the superior rectus may have been cases of paralysis or insufficiency of the contra lateral inferior oblique and passed unrecognized as such.

It is unfortunate that some of the cases reported in the literature lack the necessary data upon which a correct diagnosis can be made. The diagnosis has undoubtedly been correct, but the proof *is* not furnished.

The diagnosis must be based upon the characteristic changes.

(1) In the vertical deviations as found by the excursion test.

(2) In the degree of the hyperphoria in looking up and to the R. or L. as measured by the cover test or Maddox-rod.

(3) In the vertical (not the lateral or torsional) diplopia. The frequent absence of torsional diplopia is noteworthy and therefore does not constitute an essential finding in making the diagnosis.

Too much emphasis cannot be placed upon the importance

of determining the action of the extraocular muscles in the six cardinal directions of the gaze.

In conclusion I wish to acknowledge my indebtedness to Drs. Duane and White for the invaluable help they have given me, and to Dr. Knapp for permission to report those cases seen at The Herman Knapp Memorial Eye Hospital.

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FACTORS INFLUENCING THE CHOICE OF METHOD FOR CATARACT EXTRACTION.[1]

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IN discussing Dr. Parker's valuable paper on senile cataract extraction at the A. M. A. last year, Dr. Verhoeff called attention to the common failure of cataract statistics to distinguish between types of cataract, and to the lack of attempt to determine the types best suited to the intracapsular methods; and Dr. Parker wisely remarked that the "character of the cataract should determine the method of extraction rather than our enthusiasm for any one method of procedure." No single method of senile cataract extraction is entirely satisfactory as a routine for all cases. Capsulotomy extraction, for example, while the only practical method for young patients, leaves much to be desired in the treatment of immature or of thin hypermature cataracts. Some lenses are easily extracted with forceps by Verhoeff's or Knapp's method, while in others the zonule is too strong or the capsule tears, and we proceed as we can, not as we wish. The Smith method gives ideal results under some conditions, while under others its dangers are so great as to be practically prohibitive; and the method which Prof. Barraquer has so admirably demonstrated will doubtless show its limitations in less skillful hands. For such reasons there is a growing belief that routine use of any method to the exclusion of others is not good surgery, and should give way to selection of the method which best suits the conditions of each individual case and the conditions of the operator. This implies surgical judgment and a much better

[1] Read before American Ophthalmological Society, Washington, May 1, 1922.

study of our cases, and will be simpler when the indications and contraindications of the various methods have been more carefully worked out. For this latter purpose a study of the conditions under which each type of operation has shown its best and its worst end results, and an analysis of the factors which determined those results, give more information than routine statistics. This paper records the writer's tentative conclusions from such a study, both in his own cases and in the records of many workers to whom his acknowledgments are due; especially to Colonel Henry Smith, to whom his debt of obligation is great. An experience of nine years with intracapsular extraction by pressure, including two periods of training with Colonel Smith in India, has convinced the writer that extraction in the capsule is the theoretical ideal which the future will show to be more or less generally attainable in some form; but that with the possible exception of phacœrisis, with which the writer has had no experience, the present field of both the Smith operation and of other intracapsular methods for which the pioneer work of Colonel Smith has prepared the way is limited both by the suitability of cases and by the experience of the operator. The future, however, will hold us in small regard if we do not overcome the limitations of experience, so as to be able to give each suitable patient the benefit of whatever form of operation will give him the best result.

Omitting all reference to iridectomy, preliminary or combined, the methods considered typical for the purpose of this paper are extraction after capsulotomy (either by the linear method or by the Von Graefe flap operation), and extraction in the capsule, either by pressure only as practiced by Colonel Smith, or by traction. The traction methods comprise traction with forceps as recommended by Verhoeff and Greenwood, traction with a vacuum instrument such as Prof. Barraquer has perfected, and combined traction and pressure as advocated by Arnold Knapp and Torck. As a basis of comparison between methods it is assumed that that eye does best which has the fewest necessary manipulations and the smallest amount of trauma at operation, and receives the least irritation thereafter. While intracapsular methods on the whole require fewer manipulations, they may involve more trauma

than capsulotomy methods. So far as this is counterbalanced by freedom from further irritation caused by soft lens matter and capsule, they are preferable; and this balance largely determines our choice between extraction with the capsule or without it.

The conditions or factors which influence the choice of method may differ in relative importance in each case. They are here considered in three groups, the first including the age of the patient, the type and stage of maturity of the cataract, and the presence of complications; the second having to do with such conditions as the probable behavior of the patient, the prominence or recession of the eyeball, and the size of the cornea; the third group dealing with conditions affecting the operator, including his skill and training, the frequency with which he operates, and the quality of his assistance.

The age of the patient and the type of the cataract are the first factors considered in determining the type of operation which is most suitable. In children, Colonel Smith distinguishes three clinical types of cataract: the membranous, which he extracts with forceps; the milky, which he needles; and the jelly-like flocculent cataract for which he employs linear extraction. In this country cataracts of any type in children young enough to have no nucleus (i.e. up to about 15 or 16), are generally needled, though the suction method is sometimes used for the softer ones. Beyond 18, linear extraction may be safer. The cases suitable for linear extraction were well summarized by Dr. Wilder in 1916, as all soft cataracts in which a nucleus has not yet formed or it is so small that it will readily escape through a 10*mm* linear incision, including lamellar cataracts, juvenile cortical and capsulo-lenticular cataracts, and all forms of soft or fluid complete cataracts, whether spontaneous or traumatic, up to the age of 30 to 35 years; also lenses in high myopia. As the patient approaches 40 and the nucleus becomes presumably too large for the linear incision, the Von Graefe operation becomes the operation of choice. This holds also for traumatic cataracts, unless the lens is dislocated without rupture of the capsule, when some form of intracapsular extraction is advisable.

Senile cataracts require more detailed consideration. In a general way, the younger the patient the smaller the nucleus,

and the stronger the attachments of the lens, both zonular and hyaloid. In nearly all patients under 40, in most patients under 55, and for the novice in intracapsular methods and especially the Smith method, in patients under 60, zonular rupture is apt to be too difficult, and extraction with capsulotomy is generally the wise choice. Conversely, the older the patient, the easier is the dislocation of the lens likely to be, and therefore the safer for intracapsular extraction if the lens is not too large. Barraquer considers his method suitable for all senile, but not for juvenile and congenital cataracts. In the 200 cases reported by Arnold Knapp as extracted by his method only 15 were under 55; and 1 under 40. Colonel Smith says that "Cataract in children and juveniles is not suitable for extraction in the capsule as they are exceedingly difficult to dislocate." Verhoeff pays more attention to type, and advises some method of intracapsular extraction for immature and hypermature senile cataracts, but advises against intracapsular extraction with forceps for mature cataracts and sclerosed lenses on account of the fragility of the capsule.

Four more or less regular stages and two variations from type are sufficiently distinguishable in senile cataract to be considered in relation to the type of operation best suited to them. These are Immature, Swollen, Mature, Small hypermature, Thin hypermature, and Sclerosed lenses. Immature cataracts, in which the edge of the iris still casts a shadow, usually have an anterior chamber normal in depth, and a lens fairly normal in size, shape, and consistency. The transparent cortex adheres to the capsule and it is impossible to see it so as to get it all out. Because the eye does not do as well if it is not gotten out, capsulotomy operations are not very satisfactory, and many men therefore postpone such operations as long as possible; these cases are well suited however to intracapsular extraction as the capsule is usually reasonably strong. If the patient is old enough to make zonular rupture by pressure easy, the Indian operation goes very well; the zonule ruptures above in the early stages, below in the cases which are near the swollen stage. Where zonular rupture by pressure is not easy, rupture by traction is advisable, either with forceps if the capsule is not too tense to wrinkle and can be grasped by them, or by the vacuum method of Barraquer: but the capsule is

more likely to be torn in these cases which are difficult to dislocate by pressure from the outside.

The next stage is the swollen or intumescent cataract which has just become mature, and is pearly white and flocculent. Here the anterior chamber is shallow, the lens larger and rounder than normal, and the capsule is thinned and tense, too weak to allow any form of intracapsular extraction by traction, which is therefore contraindicated. These are easy cases for extraction with capsulotomy, or for intracapsular extraction by pressure. They are the easiest and the safest cases on which the beginner may try the Indian method. Quick pressure with the point of the hook at the lower margin of the cornea ruptures the zonule below, and they tumble out bottom first with gentle follow up pressure. In this type many of us have had cases where the patient has expelled the lens in its capsule involuntarily, sometimes with loss of vitreous, and have been surprised at how well they have done. These lenses, though large, often mold easily, so that the exact size of the wound is less important. The capsule, however, is apt to be very fragile, and may rupture if pressure is increased too rapidly before the largest diameter of the lens has passed the wound, or if the capsule is touched with the point of the hook, or if the wound is too small. For this reason the final removal of the lens from the wound is best performed with the curve of the hook. If the capsule ruptures and hangs partly out of the wound, Colonel Smith's method of grasping it with anatomical dissecting forceps with long approximating surfaces, held parallel to the wound, is very efficacious, if a conjunctival flap is not in the way. If the burst capsule is entirely inside the eye, which should rarely happen, Smith's or Kalt's forceps, or any delicate angled forceps with long approximating surfaces, serve the purpose, but require skillful handling to avoid rupture of the hyaloid membrane.

In the third or mature type, the anterior chamber is again of normal depth, and the lens normal in size but rounder. The capsule is often still too weak in recently matured cataracts for intracapsular extraction by traction, but becomes stronger and more suitable for this operation as these cases approach the hypermature stage. With this exception, mature cataracts may be extracted by any method, if one remembers that

the younger the patient the harder to rupture the zonule, and the older the patient the larger the nucleus is apt to be. Both extremes are probably safer by capsulotomy, especially in less experienced hands.

The fourth or small hypermature stage is not common. Here the anterior chamber is deep, and the lens which is small and round with a thick strong capsule is easily dislocated by attempt at capsulotomy to which it is quite resistant. These cases are perhaps best suited to intracapsular extraction by one of the traction methods, as in intracapsular extraction of any small lens by pressure only, careful manipulation is required, or vitreous will appear in the wound ahead of the lens and make extraction on the spoon unavoidable.

The fifth variety of senile cataract is the thin flattened lens. This is the more common form of hypermature cataract, though the thin lens may occasionally be met with in immature or mature cases. Here the anterior chamber is abnormally deep, the iris often tremulous, and the lens of a perfectly uniform whitish color often slightly tinged with yellow brown. These lenses are much thinner than other forms of cataract, even approaching the disk phonograph record in shape. The capsule is thick and strong, and capsulotomy is contraindicated as it is often so difficult that the zonule gives way rather than the capsule, especially if capsule forceps are used. Intracapsular extraction by pressure only usually ends in spoon extraction with loss of vitreous, as the thin lens cannot be made to fit the wound, and is therefore contraindicated. Intracapsular extraction by traction therefore seems to be the ideal method for these cases. Shrunken membranous cataracts and after cataracts which resist discission, likewise invite intracapsular extraction by traction. This may also be done with a Tyrrel hook through a linear incision, as advocated by Dr. Wilder.

The sixth variety comprises the sclerosed lenses, which are mostly very large nuclei, and occur only in advanced age. They vary in color from light amber with well-marked radiating striæ to almost black. If there is some cortex present they may have a whitish sheen. The anterior chamber is normal or a little shallow, and the pupillary reflex is apt to be sluggish in the darker ones. These require a large section, and

for the average operator, capsulotomy extraction is safest. For the experienced operator the Smith operation is ideal, as these are old patients and the zonule ruptures easily, but the large round lens fits the wound pretty tightly, and a sure technique and a light hand are necessary during the minute or two required for the lens to mold itself sufficiently to pass a full-sized wound. Even after capsulotomy these nuclei often come out molded to an oblong, and with the edges scraped off by the wound. Because of the fragility of the capsule, extraction by traction of large sclerosed lenses would seem to be contraindicated.

The recognition of these six types of senile cataract offers no great difficulty to one who studies his cases carefully. To predict correctly, however, before the operation the size, shape, and consistency of the lens in each case, and the strength of the capsule, advantageous as it is to the operator, requires much experience. Many who saw Colonel Smith operate last year remarked his seemingly almost uncanny ability in this regard. It is of course much easier to the man who is doing intracapsular extraction, as he has the great advantage of being able to check up his prediction in each case by examination of the lens in its entirety in the capsule after extraction. But it can also be done to a considerable degree by the man who is doing mainly capsulotomy operations, if he makes his prediction in every case and checks it by what he finds at operation.

The presence of complications should be a factor in the choice of method. Highly myopic eyes, with their tendency to retinal detachment should have the slightest possible vitreous disturbance, and so perhaps go best by the gentlest capsulotomy operation, with the smallest section which will allow the easy escape of the nucleus. So also eyes with probable disease of the vitreous. Eyes with a tendency to glaucoma, however, seem to be safer with intracapsular extraction, probably because of their freedom from soft lens matter, from blocking of the pupil, and from capsular tags in the wound. Eyes with posterior synechiæ, with tendency to disease of the uveal tract, and perhaps patients with certain focal infections, do better with intracapsular extraction on account of the much greater freedom from postoperative iritis when the capsule is entirely out. This is quite marked in diabetic patients who do

particularly well under intracapsular extraction, though many of them also do well with capsulotomy if made sugar-free before operating. Posterior synechiæ, however, interfere with the use of forceps or the vacuum cup, so that intracapsular extraction by pressure only, if not otherwise contraindicated, is the method of choice. For dislocated lenses, Colonel Smith's method of extraction in the capsule upon the spoon as a fixed inclined plane, given a good operator and a good assistant, produces the smallest possible loss of vitreous, and the largest number of useful eyes.

Having made the choice of operation from the standpoint of the type, maturity and complications of the cataract, and the age of the patient, we have further to consider whether that choice is suitable for the individual patient, or should be influenced by such conditions as the prominence of the eyeball, the size of the cornea, and the probable behavior of the patient during and after the operation. The plump, restless patient with bulging eyes and tightly fitting lids is not ideal for any form of intraocular operation. If the straplike lids cannot be lifted far enough away from the globe to allow ample room for manipulation of instruments, both for extraction and for completing the toilet of the wound, and if the orbicularis cannot be restrained so that under no conditions can the patient make lid pressure on the globe, intracapsular operations are risky and may be disastrous. Under such conditions capsulotomy should be done if not absolutely contraindicated by the type of cataract. In good patients the anterior chamber may be irrigated, but much instrumentation invites trouble. Those cases in which the orbicularis is spasmodically active are perhaps also best handled by capsulotomy, unless they are put well under the influence of bromide, or unless the operator is confident of the ability of his assistant to prevent squeezing and his own ability not to provoke it. On the contrary, poorly nourished patients with sunken deep-set eyes and flaccid lids are ideal for intracapsular extraction. The predominance of this type in India is a real factor in the success of intracapsular extraction there. And it is the opinion of the writer that the frequency of the prominent eye among our well-fed Americans is one of the reasons for the lack of equal success with intracapsular methods here, especially for the

much higher percentage of vitreous loss in unselected routine cases. Colonel Smith believes that overfed patients should be well purged before operation. He also classes the Negro type and the German type, who have no superciliary ridge on the frontal bone, with the prominent eye group.

The small cornea is unsuitable for intracapsular extraction unless the entire section is made well in the sclera, so as to get it large enough. In other words, two to three millimeters of the sclerotic surrounding the small cornea behaves like cornea and must be considered as cornea rather than as sclera, and the section made accordingly. As Colonel Smith says, "Small cornea do not imply small lenses, nor do they imply shallow anterior chambers, and the sclera may always be safely transfixed in these cases." Unless this is done the wound will prove too small, and this is much more serious in intracapsular than in capsulotomy extraction. For this reason, capsulotomy is advisable for the average operator.

Very bad patients require a general anæsthetic, unsatisfactory as that often is. The doubtful ones should be put well under the influence of bromide. The probable behavior of these doubtful ones may be inferred from the way they react to the section and to the iridectomy, and the final choice of method may have to be deferred until that time. In proportion as the behavior of the patient promises to be uncertain, the simpler method of extraction with capsulotomy should be chosen.

The third group of factors influencing the choice of method comprises such conditions as the dexterity, training, and versatility of the operator, and the dependability of the assistant. Mr. T. Harrison Butler said at the last Oxford Ophthalmological Congress: "Operators vary in dexterity, and the same surgeon may operate with more or less skill at different times. Some men charm the lens out, others extract it, not a few express it, and a few paw the lens out. A nervous operator in some telepathic way communicates his mental state to the patient, and is not likely to get good results." While this is true of any method, it has its greatest importance for extraction in the capsule. Likewise the ability to sense what a patient is going to do next, and to maintain that subtle subconscious contact by which the critical moment is tided over in safety.

As to the amount of skill and training necessary to do intracapsular operating satisfactorily, each operator, if he has selected the type of operation best suited to the case, must judge by his results. Some men are handicapped from the beginning in intracapsular work. Such are the heavy-handed man, the timid man who lacks self-confidence and the judicious boldness needed to pull out of difficulties successfully, the man without mechanical or natural operative ability, the man who begins intracapsular work when he is past middle age, the man who has had no personal training such as we have all had in capsulotomy methods and the man who expects to fail. Such men will do well to choose intracapsular methods only for the easiest cases, until they have so far as possible overcome those handicaps.

Extraction in the capsule by any method is more difficult than extraction after capsulotomy, until its entirely different principles are mastered in practice as well as in theory. The question of difficulty, however, will not arise when we are more familiar with it. Like any other slight-of-hand performance, it should be learned before one is too old, and requires not only good hands, but training and keeping in practice. The man who is doing it frequently may perhaps do it on a wide variety of cases with success, but the man who does it rarely will be in difficulties unless he selects it only for the most suitable cases, and has the versatility and the courage to change his method at any stage of operation, if he finds unforeseen conditions make it wise to do so. The more carefully he studies his cases, and comes to know the size, shape, and consistency of the lens beforehand, the less should such change be needed.

The amount of force required, and the question of vitreous escape, have also to be considered in the choice of method. In intracapsular extraction, whether by expression or by traction, (and perhaps expression requires the better hands and the finer and quicker gradation of force), it is the amount of damage done to the eye which determines the suitability of the method. The smallest amount of force which, properly applied, *can* produce the result should rarely need to be exceeded in suitable cases if the section is large enough for the lens. For this reason it is better to err upon the side of a large section, as near one-half the sclerocornea as possible. If then the firmer

zonules are ruptured by traction, rough handling should never be necessary. That many of us have seen injudicious force used while demonstrating intracapsular extraction as a routine operation, perhaps with untrained assistants, and have seen the inevitable results of that force in disturbance or loss of vitreous, iris complications, and iridocyclitis, does not argue that such force is ever necessary in well-selected cases. If one finds that he has selected his operation badly, and the amount of force required to rupture the zonule by pressure or by traction is too great to be wise, he should do a capsulotomy if possible, rather than persist. After the zonule is ruptured, only the very large lenses require much pressure for their expulsion, and these principally where the wound is under 180 degrees. Here the wound should be enlarged or the capsule opened or moderate pressure continued sufficiently long for the lens to mould to the wound, rather than increase the amount of force unwisely. Low tension eyes when relieved of all lid pressure often dimple so greatly to the hook as to make it seem to the bystander that enormous pressure is being used. But the operator knows that he seldom has to use materially more force to express a lens in its capsule after the zonule is free than he would use to express a nucleus of equal size through the same wound, especially if counter pressure be made with the spatula on the sclera well back of the wound, to make the lens come forward.

Escape of vitreous is almost inevitable in extraction of dislocated lenses by any method, but is least in amount by Colonel Smith's method of extraction on the inclined plane. Vitreous escape is frequent in the extraction of small hypermature and very thin lenses by any method, unless it be intracapsular extraction by traction. In capsulotomy methods, vitreous escape is most often due to thick capsules, to prominent eyes, bad patients, orbicularis spasm, and unwise instrumentation: assistance is a minor factor. In intracapsular extraction by pressure vitreous escape is most often due to poor assistance; next, to lack of intracapsular experience or ability, prominent eyes, strong zonules, small sections, and small lenses. Intracapsular extraction by traction probably shows the same causes except insofar as it may handle strong zonules and small lenses better. The factors influencing vitreous escape thus differ

widely in relative importance in different methods, a fact which has not been sufficiently appreciated in statistics. Since escape of vitreous practically does not occur without zonular rupture, it is theoretically facilitated by intracapsular methods where zonular rupture is a necessary part of the operation, and requires greater skill to avoid than in capsulotomy methods, where both the capsule and the hyaloid hold it back. In practice this applies chiefly to fluid vitreous, escape of which is somewhat more frequent in intracapsular than in capsulotomy extraction, but is usually very much less in amount on account of the absence of lid pressure. In fact it is sometimes very difficult to be sure whether a drop of fluid vitreous has really escaped or not, and whether a trace adheres to the lens. Its greater frequency under such conditions is usually more than compensated for by the other advantages of extraction in the capsule. Loss of normal vitreous on the contrary is always serious, or may be so, though less serious when the capsule is entirely out. With properly selected cases, however, a well-trained operator with a good assistant should lose normal vitreous less often by intracapsular methods than by capsulotomy, on account of better lid control. The reverse is true for an untrained operator, or assistant, or with poorly selected or routine cases.

The quality and the dependability of the assistant is an extremely important factor in the choice of operation. For linear extraction little more assistance is needed than for a discission. Capsulotomy extraction in good patients may also go well with little assistance, though if the patient misbehaves or complications arise, most of us prefer a trained assistant with whom we are accustomed to work. Much more so is this true in intracapsular work where absence of lid pressure must be maintained for as long as may be necessary, surely, steadily, unquestionably, but without ever overdoing it so as to cause discomfort to the patient. To do this well, and at the same time keep out of the operator's way, is an art which some assistants learn more quickly than others, the more quickly if the assistant has done intracapsular extraction himself, and has thus a working knowledge of its essential principles and dangers, and the way in which accidents come about. The younger or the

more restless the patient, the more prominent the eye, the more difficult the rupture of the zonule, the tighter the lens fits the wound, and when complications of any sort arise, the more necessary is an assistant who knows the game and instinctively works with the operator instead of against him. In intracapsular operating one is much more at the mercy of his assistant than in any other eye operation. The writer at one time found it a practical necessity to limit his intracapsular work very sharply, as unnecessary loss of vitreous after the lens was out and inability to complete the toilet of the wound, due in large part to a succession of untrained assistants, became too frequent. Later when competent assistance was again available, intracapsular extractions were again done freely, and went as well as ever. The writer at present employs two assistants. One stands behind the operator and holds back the brow and orbicularis with gentle pressure of four fingers. The other at the patient's left, holds the upper lid up and forward on a Fisher lid retractor, and with a bit of cotton under his left thumb pulls down the lower lid by gentle pressure against the lower margin of the orbit. This gives a very satisfactory exposure if firmly and gently done. When the operation is finished, the operator takes the brow and the retractor and eases the lid into place, the assistant relaxing the lower lid last of all. The training of a good assistant is not always easy, and it may be advisable to try a few capsulotomy operations with the lids held well off the globe as for intracapsular work, so that the operator and assistant may become accustomed to working together in the new positions, before attempting extraction in the capsule.

This completes the survey of the more important factors influencing the choice of method for cataract extraction. They have been so briefly outlined that further summary is difficult. In a general way, however, the younger group of patients do better by capsulotomy methods, as do extremely large lenses unless the operator is well trained. Intracapsular extraction by traction requires a strong capsule which is only to be expected in the very late mature and the hypermature cases, and in membranous and after cataracts, though it may be found in some early immature cases also. Intracapsular extraction by pressure requires a reasonably weak zonule and not too

small a lens. This is to be expected in the immature, the swollen, and the early mature stages, especially in older patients. Dislocated lenses and cases complicated by glaucoma or uveal disease invite extraction in the capsule, as do also sunken eyes. Prominent eyes, small corneæ, bad patients, and cases where extreme gentleness is necessary invite capsulotomy. Better training of both operator and assistant is required for intracapsular than for capsulotomy extraction, and questions of doubt should therefore be resolved upon the side of capsulotomy. When a larger experience has taught us the advantages and the limitations of extraction in the capsule, it will doubtless take its proper place as the operation of choice in suitable cases, for when well done it gives a cleaner, sounder, better lasting eye than extraction with capsulotomy. Especially is this true for the Smith method which, under good conditions approaches the ideal. When we have acquired more intracapsular skill and experience in the various methods, the number of suitable cases may be found very large. But under present conditions, for the sake of our patients, we should choose intracapsular methods only for the cases where they are definitely indicated, and should choose that method which involves the minimum of trauma for that particular case.

Believing that the younger operator should try out intracapsular operating for himself on easy cases, as far as it may be done with safety, it is the hope of the writer that these hints as to the selection of cases and to the avoidance of the more common factors inviting complication, may help to make up to him for the lack of personal training which he has received in the older methods, and that having acquired experience, he will try to select that method for each individual case which is most likely upon that occasion to give that patient, under his conditions and the conditions of the operator, the best seeing, the best lasting, and the best looking eye.

PARALYSIS OF DIVERGENCE WITH REPORT OF THREE CASES DUE TO EPIDEMIC ENCEPHALITIS.

By Dr. J. H. DUNNINGTON, New York.

(With three figures in the text.)

PARINAUD in 1883 gave us the first clear and correct description of paralysis of divergence. As early as 1860 von Graefe recognized as a clinical entity its characteristic symptoms but wrongly interpreted his findings. He believed the trouble to be myopathic in origin. Parinaud and others in the early 80's doubted the correctness of von Graefe's theory and considered the trouble of innervational origin. However, it remained for Duane in 1899 to clearly demonstrate the correctness of Parinaud's contention and to refute von Graefe's hypothesis. Von Graefe, Theobald and other early writers thought the act of divergence to be a purely passive affair brought about by a relaxation of convergence. Consequently they did not believe in the existence of a paralysis of divergence but interpreted these cases as due to a spasm of convergence. We now know that the power of divergence is an active as well as a passive affair which is brought about by a simultaneous equal contraction of both external recti accompanied by simultaneous equal relaxation of both internal recti. This complex action is controlled by a definite nervous mechanism and the loss of this power means an innervational disturbance and not a muscular defect.

Duane has taught us to recognize an homonymous diplopia and convergent strabismus of sudden onset as the cardinal symptoms. This diplopia is peculiar in that it is greatest at a distance of twenty feet or more and diminishes as the eyes are

approached. The separation of the images does not increase in any of the cardinal directions of gaze but remains unchanged so long as the distance between the object and the eyes is constant. A point of binocular single vision is reached at about 25 centimeters from the eyes which is known as the point of single vision by approximation. From this point the test object can be carried away from the eyes for a few centimeters before diplopia is gotten. The most remote point of binocular single vision obtained in this manner represents the point of single vision by recession. For the difference in these distances Alger gives the following explanation:

"Paralyses of divergence automatically result in stimulation of convergence as the fixation point is approached to the eyes. When, however, it is carried away from them, convergence is automatically relaxed and though in this case it cannot be accompanied by any increase in the paralyzed function of divergence, the very relaxation permits some single vision by recession.

The convergent strabismus behaves in an exactly similar manner to the diplopia *i.e.*, it is greatest at a distance and diminishes as the eyes are approached. Measurement of the deviation shows a marked esotropia at twenty feet and only a slight esophoria at thirteen inches. These patients then have binocular single vision at the reading distance but a distressing diplopia beyond this range. There is no limitation of motion of either eye in any field, both eyes being able to move outward in a perfectly normal manner.

PARALYSIS OF DIVERGENCE.

The diagnosis is most commonly confused with a paralysis of the external rectus either unilateral or bilateral. The characteristic feature of a diplopia due to an individual muscle paralysis is its variation in amount in the different directions of gaze. The separation of the images increases markedly in the field of action of the paralyzed muscle. As already stated a diplopia resulting from a loss of the power of divergence remains unchanged in all fields so long as the distance between the object and the eyes is constant. The character of diplopia present in paralysis of divergence, in paralysis of left external

rectus and paralysis of both external recti is shown by the accompanying plottings.

Fig. 1 illustrates the constancy of the distance between the two images in all fields in paralysis of divergence. Fig. 2 gives us a clear picture of the increase in separation of the images on moving the eyes to the left seen in paralysis of the left

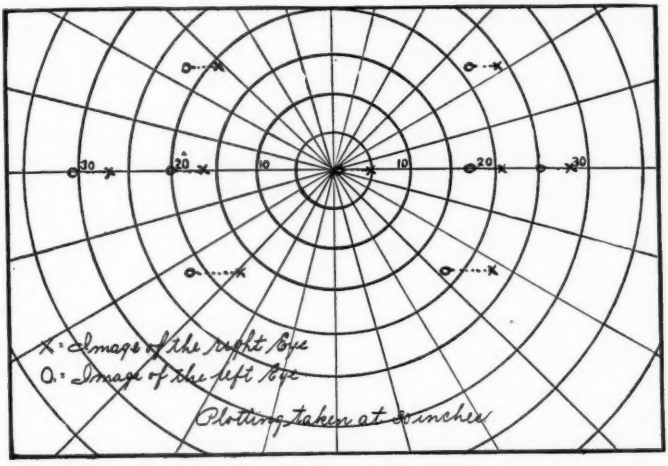

FIG. 1.—Paralysis of Divergence.

external rectus, while Fig. 3 shows the increase in both lateral fields obtained in paralysis of both external recti. These diplopia fields were mapped out on a Duane tangent screen at a distance of 30 inches. Limitation of motion in the field of action of the paralyzed muscle is another characteristic sign of muscular paralysis which is absent in paralysis of divergence. An accurate diplopia plotting is our greatest aid in establishing the diagnosis, for a slight limitation of motion may readily escape detection but if any lagging occurs the diplopia increases in that field. A failure to find any variation in the separation of the images in the different fields shows the lesion not to be due to an individual muscle paralysis. Spasm of convergence is frequently confused with paralysis of divergence. If the diplopia or the deviation is due to an excess of convergence it increases as the test object is brought nearer to the eyes and is

negligible at a distance of twenty feet. This is just the reverse of what we have seen happens in paralysis of divergence, where the diplopia or the deviation is greatest at a distance and negligible at close range. A comparison of the distance findings with those at thirteen inches differentiates these two conditions.

The etiological factor in paralysis of divergence remains obscure in the majority of cases. An organic brain lesion appears to be the causative factor in some of them. Syphilis, tabes, multiple sclerosis, lead poisoning and cerebral tumor have been enumerated as possible causes by Duane. Wheeler in view of the acute onset, absence of positive laboratory findings and permanency of the condition considered his case to be the result of a localized hemorrhage brought on by violent physical exertion. Alger has seen the condition occurring in chronic nephritis with high arterial tension and argues from the acuteness of the onset that it was most probably due to a localized hemorrhage in the center of divergence. Duane agrees when he says:

"In the majority of cases the affection occurred without obvious cause although from the suddenness of development and the permanence of the symptoms it seems not unreasonable to infer that it was due to a localized hemorrhage."

Alger reported a case of diphtheritic origin and Cutler has seen it in poliomyelitis. Many ocular muscle paralyses have in the past few years been attributed to epidemic encephalitis. Numerous cases of paralysis of convergence from this cause are recorded in literature so it is surprising that only two authors have reported cases of paralysis of divergence occurring in this disease. Zentmayer in 1919 reported a case of this type and at that time considered it a sequel of influenza, doubtless it was due to epidemic encephalitis. Holden in his article on "The Ocular Manifestations of Epidemic Encephalitis" mentions one such case seen by him. As no complete description of these cases are given I consider it of sufficient interest to report in detail my cases.

The exact location of the center of divergence has long been disputed. Parinaud in his original description located the center in the cerebellum. Cases of paralysis of divergence occurring in cerebellar disease were cited to substantiate this belief. However, as the result of the teaching of Duane we

have come to believe that the location of this center is in the immediate vicinity of the sixth nerve nuclei. The frequency with which paralysis of divergence is followed by involvement of one or both sixth nerves is more than mere coincidence. Also an external rectus paralysis may change into a paralysis of divergence. This tendency towards an interchange of the two conditions is our best argument for the close proximity of the center of divergence to the sixth nerve nuclei.

The prognosis of paralysis of divergence is very uncertain. We are told the majority of these cases remain unaffected by treatment. However, in my opinion it depends entirely upon the cause. If for example it follows diphtheria I should feel encouraged as to the ultimate outcome. The prognosis in cases due to epidemic encephalitis should be extremely guarded. We know that this disease is characterized by periods of long remission so I should not regard a case with this etiology as cured until it had remained without symptoms for two years.

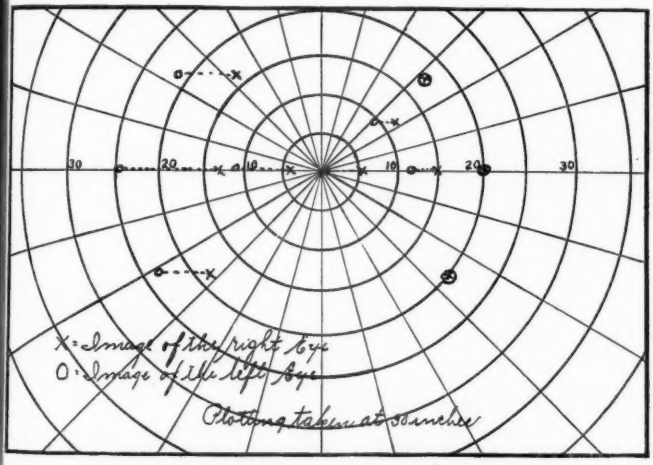

FIG. 2.—Paralysis of Left External Rectus.

Some of the ocular muscle lesions in epidemic encephalitis clear up with surprising rapidity while others hang on with invincible tenacity.

The ideal treatment of paralysis of divergence is one directed

at the cause but usually this is unsuccessful. Our treatment then is at first largely symptomatic. Relief from the distressing diplopia is best brought about by the use of a cover or a ground glass before one eye as in any diplopia. It is not practicable on account of the large amount of deviation in complete loss of power of divergence to correct the diplopia with prisms. When the condition has become stationary operation is indicated. As we have no control over the divergence center our activities must be confined to strengthening the external recti in an endeavor to make them functionate normally with subnormal stimulation. In my opinion a Reese resection of one or of both external recti is the operation of choice.

Case No. 1.

S. A., Salesman, age 23.

On March 29, 1922, the patient came under my observation in Dr. John M. Wheeler's clinic at the New York Eye & Ear Infirmary with the complaint of double vision. He went to bed the night before feeling perfectly well and slept all night. On getting up in the morning he noticed everything appeared double. His previous history was negative; he had never been sick before in his life.

V.O.D. = $\frac{1}{40}$ with +0.75 Sph. = $\frac{1}{15}$
V.O.S. = $\frac{1}{40}$ with +0.75 Sph. = $\frac{1}{15}$

The conjunctiva, the lids and the fundi were normal. His pupillary reactions were equal and normal for light both the direct and the consensual, with no reaction to accommodation in either eye. The examination of the ocular muscles showed:

20°[1] Esotropia with alternate fixation at 6*m*.
8° Esophoria at 30*cm*.
Near point of convergence (P. c. b.) 115*mm*.
20° Homonymous diplopia at 6*m*.
Binocular single vision by approximation at 30*cm*.
Binocular single vision by recession at 45 *cm*.
Orthophoria at 15*cm*.
No limitation of motion of either eye in any field.
Diplopia plotting at 75*cm* showed no increase in either lateral field (Fig. 1).
Accommodation 1.50 diopters in each eye.

March 31, 1922, two days later, the patient came complaining of headache and drowsiness. The muscle findings were unchanged at this time. A neurological examination

[1] The degree sign means prism diopter.

was made at this time by Dr. Hubert S. Howe with the diagnosis of epidemic encephalitis. Reports from the Wassermann, X-ray of nasal accessory sinuses and urinalysis were negative.

On April 5, 1922, just one week after the onset all diplopia and lethargy had disappeared. Examination at this time showed:

2½° esophoria at 6*m*, a prism divergence of 4° at 6*m*, 2° exophoria at 30*cm*, and a near point of convergence of 135 *mm*. His accommodative power was 2 diopters in the right eye and 1.50 diopters in the left eye. This condition remained unchanged for the next three weeks. Examinations made at weekly intervals after this time showed a gradual return of his accommodative power until on July 26, 1922 he had 8.50 diopters of accommodation in each eye and was perfectly well in every respect. The patient remained quiet at home for the first month but at the end of that time resumed work. No medical treatment was prescribed other than small doses of potassium iodide.

Case No. 2.

A. R., Stenographer, age, 17.

April 19, 1922 the patient came to Dr. John M. Wheeler's clinic at New York Eye & Ear Infirmary with the following history:

She awoke on April 17, 1922 seeing double. The night before she had noticed nothing unusual. For the past week she had had a dull headache and had felt drowsy at night and whenever not actively occupied.

V.O.D. = $\frac{1}{20}$ with + 0.75 Cyl. ax. 180 = $\frac{1}{15}$.
V.O.S. = $\frac{1}{20}$ with + 0.75 Cyl. ax. 180 = $\frac{1}{15}$.

Muscle Findings:

18° Esotropia with alternate fixation at 6*m*.
18° Homonymous diplopia at 6*m*.
The diplopia did not increase in any field on the tangent screen.
Binocular single vision by approximation at 45*cm*.
Binocular single vision by recession at 62*cm*.
10° Esophoria at 30*cm*. Orthophoria at 12*cm*.
Near point of convergence (P. c. b.) 80*mm*.
No limitation of motion of either eye in any field.
Accommodation 10 diopters in each eye.

Conjunctiva, lids and fundi were normal as were the pupillary reactions to light and accommodation.

April 21, 1922, two days later, she showed:

10° Esotropia at 6*m*, 3° esophoria at 30*cm*, orthophoria

at 25*cm*, binocular single vision by approximation at 65*cm* and by recession at 1.5*m*.

April 25, 1922. Has not seen double for the past 48 hours but is still drowsy.

10° Esophoria for distance, prism divergence 1°, 3° esophoria for near. Accommodation 10 diopters in each eye.

June 1, 1922. Patient feels perfectly well.

2° Esophoria, prism divergence 4°, 2° exophoria for near, near point of convergence 90*mm*. Accommodation 10 diopters in each eye.

Wassermann and all other laboratory tests were negative. Neurological examination made by Dr. H. S. Howe at the end of the first week revealed "no distinct abnormality but I am quite sure she has had a mild epidemic encephalitis." The treatment followed was purely symptomatic. She was advised to remain quiet in bed but only stopped work until the diplopia had disappeared.

Case No. 3.

I. B., school boy, æt. 12.

January 12, 1921:

Ten days ago (January 2, 1921), patient first complained of a sharp pain "like electricity" starting on the outer side of the right thumb and passing up the outer side of the arm. Thispain lasted one minute, disappeared for ten minutes, and then reappeared. The pain was so intense he could not use the arm. Seven days later (January 9, 1921), the patient woke without the pain but felt very weak and felt sleepy all the time. The next day he noticed that everything appeared double when looking at a distant object and only blurred close up. The patient came to Dr. John M. Wheeler's clinic at the New York Eye & Ear Infirmary on January 11, 1921, complaining of double vision and drowsiness.

V.O.D. = $\frac{20}{40}$ with a +1.00 Sph. = $\frac{20}{20}$.

V.O.S. = $\frac{20}{40}$ with a +1.00 Sph. +0.50 Cyl. ax 90 = $\frac{20}{20}$.

Cornea and media clear, pupils moderately dilated and equal reacting sluggishly to light and accommodation. Interior of both eyes normal.

Muscle Findings:

30° Homonymous diplopia at 6*m*.
35° Esotropia with the right eye fixing at 6*m*.
6° Esophoria at 30*cm*.
Near point of convergence (P. c. b.) 80*mm*.
Binocular single vision by approximation at 40*cm*.
Binocular single vision by recession at 50*cm*.
No increase in the diplopia in any field on the tangent screen.

No limitation of motion of either eye in any field.

Accommodation O.D. 4 diopters. O.S. 3.50 diopters.

All during the examination the patient showed a marked tendency to fall asleep and the responses were gotten only by constantly urging him to pay attention. The diagnosis of paralysis of divergence with a partial bilateral internal ophthalmoplegia due to epidemic encephalitis was made. The patient was referred to Dr. Hubert S. Howe who ad-

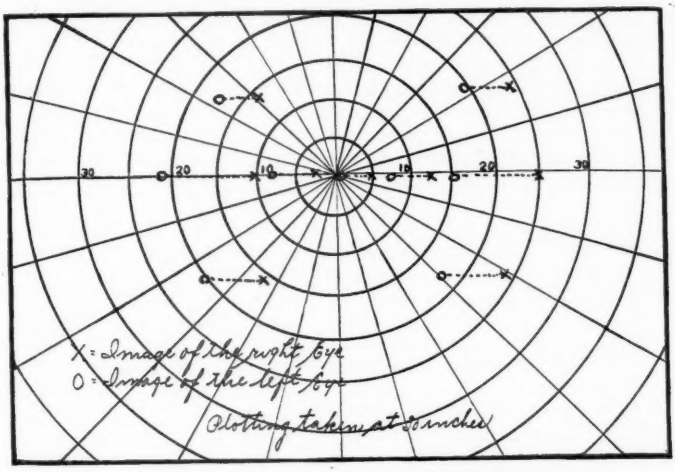

FIG. 3.—Paralysis of Both External Recti.

mitted him on January 13, 1921, to Presbyterian Hospital for treatment after confirming the diagnosis of epidemic encephalitis.

Under rest in bed, spinal punctures and symptomatic treatment the patient recovered from all lethargy on January 27, 1921, but still had double vision for which the covering of one eye was advised. Guinea pig injections with the spinal fluid ruled out the possibility of a tubercular infection.

On January 27, 1921, Ocular muscle examination showed:

35° Homonymous diplopia at 6*m*.
35° Esotropia at 6*m*.
20° Esotropia at 30*cm*.
Binocular single vision by approximation at 15*cm*.
Binocular single vision by recession at 22*cm*.

Accommodation O.D. 4.50 diopters. O.S. 4.50 diopters. There was evidently a beginning spasm of convergence complicating the paralysis of divergence.

On February 5, 1921, he still complained of diplopia. There had been no change in the lateral imbalance but added to it was 5 of right hypertropia for distance and near. This hypertropia increased to 10° in eyes up and left. The diplopia plotting showed an increase in vertical diplopia in that field. Evidently there had been an involvement of the superior rectus of the left side.

On February 7, 1921, the patient was discharged from Presbyterian Hospital as diplopia was the only remaining symptom. After being out of the hospital one week the patient had a return of the lethargy accompanied by dysphagia. He was admitted to the hospital on February 28, 1921, and after being in bed for three days he was well again except for the diplopia. He was discharged from the hospital on March 16, 1921, at which time he was not seeing double. The muscle tests showed: 13° esophoria at 6*m*, 10° esophoria at 30*cm*, no hyperphoria for distance or near, prism divergence 2°; no diplopia on the tangent screen.

On April 2, 1921, he showed 6° esophoria at 6*m*, prism divergence 4°; 2° esophoria for near, and a near point of convergence of 80*mm*. Accommodative power 12 diopters in each eye. This condition persisted until June 22d, when after a fit of anger the patient suddenly had a return of the diplopia. Examination on June 25, 1921, showed:

16° esotropia in the primary position for distance and near. Plotting on the tangent screen showed an increase in diplopia in eyes right and in eyes left indicating the existence now of a bilateral external rectus paralysis. (Fig. 3.)

Accommodative power was right eye 6.00 diopters, left eye 5 diopters. The diplopia persisted about ten to twelve days then cleared up.

July 19, 1921:

Examination showed 3° esophoria for distance, prism divergence of 4°; esophoria 5° for near. Near point of convergence 90*mm*. Accommodative power 12 diopters in each eye. The patient had been entirely free from all symptoms up to May 15th, 1922, when last heard from.

Ophthalmoscopic examination has at all times been negative and the vision in each eye always been correctible to $\frac{20}{20}$.

This case report shows the complexity of the ocular muscle lesions in epidemic encephalitis. For in addition to a paralysis of divergence he had a bilateral partial ophthalmoplegia interna, a paresis of the left superior rectus, and finally in a recurrence it took the form of a bilateral external rectus paralysis.

I wish to thank Doctor John M. Wheeler for the privilege of reporting these cases and also to express my gratitude to

Doctor Hubert S. Howe for his careful neurological examinations.

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BITEMPORAL CONTRACTION OF VISUAL FIELDS IN PREGNANCY.[1]

By Prof. C. E. FINLAY, Havana, Cuba.

ON February 15, 1919, a case was sent to me in consultation which gave rise to the investigations which form the subject of this paper.

Its clinical history was as follows:

> Mrs. E. P. M., æt. 24, a leading society lady in the 8th month of pregnancy, had suffered a month previously a severe attack of influenza; after recovery she had developed a series of seizures of a cataleptic nature; during which she could not move, though perfectly conscious of what was going on around her. My examination of her eyes resulted as follows:
>
> Corneæ and conjunctivæ, normal; media, clear; pupillary reactions, normal; fundi (both), slight contraction of retinal arteries and dilatation of retinal veins; visual acuity (both), $\frac{20}{20}$; visual fields, temporal contraction (more pronounced on right side) for white, with marked concentric contraction for colors, the red field being larger than that for blue, there being also a crossing of the limits of the color fields on the left side.

I concluded that there existed a hypophyseal compression of the chiasm, but was at a loss as to whether this was due to a hypophyseal tumor or to an enlargement of this organ in connection with pregnancy, and as to whether the cataleptic seizures were due to the enlargement of the hypophysis or of a hysterical nature. The further history of this case has no particular bearing with this paper, the seizures continued

[1] Read at an International Congress of Ophthalmology, Washington, April, 1922.

after confinement and some of the experts who later saw the patient thought there was some endocrinic disturbance with hysterical manifestations. But the study of the case made me seek to determine whether the normal hypertrophy of the pituitary body which takes place in connection with pregnancy was of such a degree as to determine changes in the visual fields. Through the courtesy of Professor Bustamante, in charge of the Maternity Clinic of the General Calixto Garcia Hospital, I proceeded to examine the visual fields of a number of women awaiting confinement, selecting only cases that presented no general complications, with normal eye-grounds and perfect visual acuity.

The following are the reports of the 31 cases examined[1]:

CASE 1.—E. E., white, æt. 20, Cuban, pregnancy 8 months, urine normal, fundi normal, visual acuity $\frac{20}{20}$; visual fields: marked contraction, more marked in temporal half; more pronounced on left side.

CASE 2.—J. G., white, Spanish, æt. 22, 9 months pregnant; urine normal, no alb., sp. gr. 1020; fundi normal; visual acuity (each) $\frac{20}{20}$; visual fields practically normal.

CASE 3.—J. F., Cuban, mulatto, æt. 36, 9 months pregnant; urine normal; no alb., sp. gr. 1009; visual acuity (each) $\frac{20}{20}$; visual fields: marked bitemporal contraction. This patient had a normal labor on August 16, 1920, and a second examination 10 days later showed a slight reduction in the bitemporal defects.

CASE 4.—L. A., Cuban, negress, æt. 16, 9 months pregnant; urine, no alb., sp. gr. 1011; fundi, normal; visual acuity (each) $\frac{20}{20}$; visual fields: marked bitemporal contraction.

CASE 5.—A. G., Cuban, negress, æt. 16, 7 months pregnant; urine: trace alb., sp. gr. 1015; fundi: normal; visual acuity (each) $\frac{20}{20}$; visual fields: bitemporal contraction.

CASE 6.—R. G., white, Cuban, æt. 21, 9 months pregnant; urine: trace alb., sp. gr. 1023; fundi: normal; visual acuity $\frac{20}{20}$; visual fields: very slight contraction (R), slight contraction (L).

[1] The charts of the visual fields of all these cases can be found in the volume of the *Transactions of an International Congress of Ophthalmology*, Washington, April, 1922.

CASE 7.—C. C., Cuban, mulatto, æt. 29, 8 months pregnant; urine: trace alb., sp. gr. 1020; fundi: normal; visual acuity (each) $\frac{20}{20}$; visual fields: very pronounced concentric contraction, greater in temporal half.

CASE 8.—C. V., Cuban, mulatto, æt. 37, 9 months pregnant; urine: no alb., sp. gr. 1031; fundi: normal, visual acuity (each) $\frac{20}{20}$; visual fields: marked bitemporal contraction, more pronounced on left side.

CASE 9.—G. S., Cuban, negress, æt. 37, 9 months pregnant; urine: no alb., sp. gr. 1018; fundi: normal; visual acuity (each) $\frac{20}{20}$; visual fields: moderate bitemporal contraction.

CASE 10.—M. C., white, æt. 38, 8 months pregnant; urine: no alb., sp. gr. 1024; fundi: $\frac{20}{20}$; visual acuity (each) $\frac{20}{20}$; visual fields: marked bitemporal contraction.

CASE 11.—C. G., Cuban, mulatto, æt. 28, 8 months pregnant; urine: no alb., sp. gr. 1016; fundi: normal; visual acuity (each) $\frac{20}{20}$; visual fields: moderate bitemporal contraction.

CASE 12.—M. S., Cuban, White, æt. 14, 5 months pregnant; urine: trace alb., sp. gr. 1016; fundi: normal; visual acuity (each) $\frac{20}{20}$; visual fields: slight temporal contraction (R), moderate temporal contraction (L).

CASE 13.—M. C., Cuban, white, æt. 18, 9 months pregnant; urine: trace alb., sp. gr. 1012; fundi: normal; visual acuity (each) $\frac{20}{20}$; visual fields: marked bitemporal contraction.

CASE 14.—A. I., Cuban, negress, æt. 17, 8 months pregnant; urine: no alb., sp. gr. 1012; fundi: normal; visual acuity (each) $\frac{20}{20}$; visual fields: moderate bitemporal contraction.

CASE 15.—F. A., white, æt. 23, 9 months pregnant; urine: trace alb., sp. gr. 1030; fundi: normal; visual acuity: $\frac{20}{20}$; visual fields: practically normal.

CASE 16.—S. A., white, æt. 25, 9 months pregnant; urine: no alb., sp. gr. 1022; fundi: normal; visual acuity: $\frac{20}{20}$; visual fields: slight bitemporal contraction.

CASE 17.—V. A., Cuban, negress, æt. 18, 9 months pregnant; urine: no alb., sp. gr. 1005; fundi: normal; visual acuity: $\frac{20}{20}$; visual fields: slight bitemporal contraction.

CASE 18.—N. M., Cuban, mulatto, æt. 31, 9 months pregnant; urine: no alb., sp. gr. 1030; fundi: normal; visual acuity: $\frac{20}{20}$; visual fields: practically normal.

CASE 19.—C. H., Cuban, negress, æt. 28, 9 months pregnant; urine: no alb., sp. gr. 1012; fundi: normal; visual acuity: $\frac{20}{20}$; visual fields: normal.

CASE 20.—G. G., Cuban, negress, æt. 31, 9 months pregnant; urine: normal; fundi: normal; visual acuity: $\frac{20}{20}$; visual fields: slight bitemporal contraction.

CASE 21.—J. B., Cuban, mulatto, æt. 39, 9 months pregnant; fundi: normal; visual acuity: $\frac{20}{20}$; visual fields: moderate bitemporal contraction.

CASE 22.—F. I., Spanish, æt. 25, 9 months pregnant; urine: no alb., sp. gr. 1012; fundi: normal; visual acuity: $\frac{20}{20}$; visual fields: slight bitemporal contraction.

CASE 23.—C. F., Cuban, negress, æt. 16, 9 months pregnant; urine: no alb., sp. gr. 1010; visual acuity: $\frac{20}{20}$; visual fields: slight temporal contraction (R).

CASE 24.—P. R., Spanish, æt. 36, 8 months pregnant; urine: trace alb., sp. gr. 1023; fundi: normal; visual acuity: $\frac{20}{20}$; visual fields: slight temporal contraction (L).

CASE 25.—B. P., Cuban, mulatto, æt. 18, 8 months pregnant; urine: no alb., sp. gr. 1012; fundi: normal; visual acuity: $\frac{20}{20}$; visual fields: slight bitemporal contraction.

CASE 26.—M. O., Spanish, white, æt. 22, 8 months pregnant; urine: trace of alb., sp. gr. 1020; fundi: normal; visual acuity: $\frac{20}{20}$; visual fields: slight bitemporal contraction.

CASE 27.—A. A., Spanish, white, æt. 34, 9 months pregnant; urine: no alb., sp. gr. 1026; fundi: normal; visual acuity: $\frac{20}{20}$; visual fields: normal.

CASE 28.—V. S., Cuban, negress, æt. 22, 9 months pregnant; urine: trace alb., sp. gr. 1018; fundi: normal; visual acuity: $\frac{20}{20}$; visual fields: normal.

CASE 29.—C. L. V., Cuban, white, æt. 17, 8 months pregnant; urine: no alb., sp. gr. 1025; fundi: normal; visual acuity: $\frac{20}{20}$; visual fields: practically normal.

CASE 30.—A. P., Cuban, mulatto, æt. 19, 9 months pregnant; urine: no alb., sp. gr. 1016; fundi: normal; visual acuity: $\frac{20}{15}$; visual fields: normal.

CASE 31.—F. P., white, æt. 28, 8 months pregnant; urine: trace alb., sp. gr. 1031; fundi: normal; visual acuity: $\frac{20}{15}$; visual fields: normal.

From an examination of these visual fields we find that out of the 31 cases examined only 9 could be considered approximately normal; the remainder showing changes in the nature of a temporal contraction; of these 8 were slight, 9 moderate, and 5 pronounced.

These surprising results led me to a thorough study of the literature at hand in connection with the anatomical and other data requisite for a complete explanation.

For a long time I was under the impression that the observations were the only ones made in this connection, but I eventually discovered that changes in the visual fields of a similar nature to those which I have recorded have been published first by Bellinzoma and Tridondani (*Bollet. dell. Soc. med. chir. di Pavia*, 1903), and later confirmed by Forti (*Arch. di Ottalm.*, Feb., 1910), which they all attributed to dynamic or vasomotor disturbances similar to those occurring in hysteria.

This more or less forced explanation seems to me unnecessary, as the changes described can be perfectly explained by the mechanical pressure brought to bear on the chiasm by the enlarged pituitary gland, resulting from the normal hypertrophy of this organ which occurs in pregnancy. The gland increases 2 to 3 times its weight and volume during this state (Shäfer, *Endocrine Glands*, London, 1916, p. 115), this being due to increase in number of oxyphil cells (Schwangerschaftszellen) in the "pars anterior" (Erdheim & Sturm and Emory Hill, *Am. Encyclop. of Ophth.*, xiii., p. 10232); a good many of the disturbances occurring in connection with pregnancy being probably due to the corresponding hyperfunction. For the chiasm, which is situated over the center of the "sella turcica" and not in contact with its anterior border from which it is separated by a reflexion of the dura mater (cisterna chiasmatis), from behind and below by an enlarged hypophysis, this must attain at least a volume of 0.5.

The differences in the degree of the changes in the visual fields depend on the degree of hypertrophy and on anatomical peculiarities which may favor or hinder the above mentioned compression.

In conclusion I consider I can establish:

That during pregnancy there often occurs, as a result of the normal hypertrophy of the pituitary gland in connection with this state, a compression of the chiasm which manifests itself by changes in the visual fields in the nature of a bitemporal contraction which varies in degree according to the amount of compression suffered, this depending on the corresponding amount of hypertrophy and on the anatomical peculiarities of the case which may favor or hinder this compression.

After the session at which I read my paper, Dr. Blaauw, of Buffalo, handed me a note in which mention is made of a paper of Igersheimer at the meeting of the Heidelberg Society in 1916, where he mentions the changes in the hypophysis in pregnancy and the bitemporal hemianopic symptoms which occur in consequence at least in the last month of pregnancy mentioning 12 cases. I had not come across Igersheimer's paper, nor found any reference in the periodicals at my command. I gladly take this opportunity of correcting the omission in my brief survey of the literature. The original paper I have not seen, but have since the Congress found a brief extract of Igersheimer's paper, in the *Klinische Monatsblaetter*, on lesions of the optic nerve where mention is made of possible changes of a hemianopic nature in hypertrophy of the hypophysis, in pregnancy, etc.

ABIOTROPHY: OPHTHALMOPLEGIA EXTERNA.

By Dr. A. W. STIRLING, Atlanta, Ga.

IN view of the prominence given to such cases by Treacher Collins at the recent International Ophthalmological Congress in Washington, this seems an appropriate time to publish the following records:

Case 1.—Miss A. R. S., then aged 24, consulted me in December, 1919, on account of abnormality in the movement of the eyes and rather mediocre vision. The refraction was examined under homatropine and cocaine and the following glasses were ordered:

R. E. + .75 D Cyl. Axis 30 degrees (down and in) $\frac{6}{6}$.

L. E. + .50 D Cyl. Axis 60 degrees $\frac{6}{7.5}$. No fundus changes could be found.

The patient's main complaint, however, was an inability to move her eyes like ordinary people, which it seems was laid to the account of a hornet sting in the eye of her mother when six months pregnant.

My notes made at the time say "Ophthalmoplegia Externa (not complete) in both eyes, sometimes (generally) cross. Eyes can be turned to the side at times and not at others, and better when not thinking about it, worse when trying to look to right. The weakest muscle is the right external rectus. On looking with care as at test letters the right eye jumps from side to side; the left not so badly. Sees with either eye alternately, and not with both together. (As demonstrated by Red-Green Friend.)"

On July 29, 1922, I had the opportunity to see her, when I made the following notes:

The belief in her family is that she was born with eyes crossed and more or less immobile. The immobility never entirely disappeared, but she thinks that when she is unconscious of her eyes they turn more freely. She says they are perhaps better than ten years ago, but this is very doubtful. I see no improvement in three years. She always

could open and close the eyes quite normally, and there has never been any difficulty in focussing for near objects, neither has there been any paresis of shoulder or other muscles. She is a big strong-looking young woman in "absolutely perfect health."

No other member of the family is known to have had any such peculiarity as hers. On examination it appeared at first as if the right eye were usually turned a little in and up, but later observation made it doubtful whether she used one eye more than the other, one always turning in a little, perhaps 15 degrees at the most, but not to any constant extent and at times they are almost straight. She has never observed any diplopia.

A point of much interest is the difference in mobility of each eye in dependence upon whether or not the other is covered. When both are uncovered there is no movement whatever in the right eye outward; but it turns in about half the normal distance and very slightly upwards and downwards. When the left eye is covered the right will follow the finger a considerable distance, half way or more of the normal, outwards, and farther in than when both are uncovered. Covering the one has no effect on the upward and downward movements of the other. With both uncovered the left eye does not follow the finger at all in any direction; but when the right is covered the left follows the finger till the cornea touches the internal canthus. It does not, however, turn at all beyond the center in any other direction. The alternation of strabismus from one eye to the other, already noted, probably therefore always occurs during blinking.

If both eyes are uncovered and the left is turned in when the finger is carried to the right the left would be the fixing eye at a certain position, but except there neither would see it clearly. When the finger is moved to the left, the right eye being turned in could obtain clear vision but only over the limited range of its movements. It is interesting that though the vision with both eyes uncovered can be no better than with only one, an effort as effective could not be made to obtain clear vision in all positions with both open as with only one open. When one eye is covered the effort to follow the finger seems disproportionally successful, as if the motor centers were relieved of some handicap when one eye is closed. (She is constant in stating that the eyes move better when she is not thinking about them.) The weakness in such a case would appear, therefore, to be not altogether in the muscles.

(To-day, Sept. 16th: Since writing the above, Miss S. has consulted me about an abscess on the left lower lid. I took the opportunity to examine the ocular movements, and

found on this occasion that though on the last examination the conditions were as stated above, confirmed by Dr. J. Calhoun McDougall, to-day there is limited but distinct lateral movement of the left eye, which, however, is still much wider when the right is closed.)

It is also noteworthy that the patient's parents who are both alive (and her father is a doctor) seems to be convinced that their daughter's eyes have been peculiar since birth. I quote from a recent letter from her father: "Some peculiarity in R.'s eyes was apparent in her earliest infancy, but not that she did not move them normally, only that instead of looking directly at an object, she turned her head to one side (about 15 or 20 degrees) as if to focus more readily. Dr. T. saw her when she was about 3, and a number of times afterwards. If he perceived any disability of this nature (moving her eyes) he did not mention it. He thought the trouble would grow less with age, as indeed—apparently at least—it has. He also said that her trouble was undoubtedly congenital. My wife has always been unalterably of the opinion that this peculiarity was attributable to prenatal impression—she having suffered extremely from the sting of a wasp on the eyeball, about the sixth month of pregnancy before R.'s birth. R. has never had, at birth or other time, any wound about the head."

I wrote Dr. T. but he states that his record of this case has been lost.

CASE 2.—Mrs. A. T. B. (then Miss A. S., age 24) consulted me in November, 1911, at the instigation of another ophthalmologist. Her trouble had begun about two years before and she had been treated with no avail since then by various specialists who seem to have prescribed mainly mercury and potassium iodide. My notes made at the time state that she had "occasional nearly complete ptosis and ophthalmoplegia externa," and that "she gets 'quite well' at times." Pupils active to light and accommodation. "Eyes move *a little* in all directions; do not converge well. Left ptosis; eye half shut and cannot open it; never any other paresis. Fundus normal."

This patient lives in a small country town several hundreds of miles away; but she has kindly answered a series of questions which I sent her and besides has written me letters at considerable length.

Her family history appears to hold nothing of interest. As regards her own health the only complaint is a weakness and pain in the back due to a "falling of the womb" which was discovered two years ago when she had a miscarriage ("a

fine strong baby") two years after marriage, and which her symptoms and the doctors suggest had existed for a long time. "This," she says, "without a doubt has been the cause of all my eye trouble."

She states that she believed no one ever had stronger eyes until she was 22, when she thought a piece of grit flew into her eye, though no one could see it next day. The eye seemed very weak and continued so. In ten days she visited an eye specialist who wanted to operate on the muscle of her lid and prescribed glasses. She also consulted the late Dr. Graddy of Nashville, Tenn., and, through the courtesy of his successor, Dr. E. B. Cayce, I am able to give his notes made first on November 18, 1909.

"Miss A. S., age 24" (my notes say she was 24 in November, 1911) "three years ago suffered from diplopia, ptosis, headaches, etc. Eyes then corrected, treated, and relieved by Dr. D. One year ago last July returned to him for treatment and glasses changed to full correction but no relief followed. Condition at present:

"Right with glasses on $\frac{7}{10}$.
Left with glasses on $\frac{8+8}{10}$.
Wearing plus 1.50 D sp.
At 20 feet es. 15 L. H. 10. Diplopia.
April 1, 1910. Right-vision $\frac{7}{10}$.
Left-vision $\frac{8}{10}$.

"Only an occasional diplopia for short time. At 20 feet es. 4, vert. orth. Adduc. 3, abduc. 10."

I have tried to get notes of this case from two others who saw her, but they could find none.

She seems then to have consulted a number of other opthalmologists in different cities and at least one nerve specialist who apparently advised drugs which did not, however, prevent the onset of "very bad" double vision. These symptoms later partially or wholly disappeared, and indeed she thinks she was quite free from them for a period of "two to four months." But two years after this first appearance the symptoms she says got bad again. "I could scarcely open the left eye at all and the right eye would open wider as the left lid drooped, and I was very weak and nervous, would have weak spells as though I had no life in me."

Some eight years ago she decided that doctors could not help her, though she has "the kindliest feelings toward them," and her symptoms have continued apparently with much the same irregularity as before. She states that "from the beginning up to the present time (June, 1922) my left eyelid will only partly raise. Sometimes this only lasts one

day, and then 'tis weeks, perhaps months until it is weak again. If I am not feeling very well, this is when it most frequently is wrong, and it is not always standing at the same place. Sometimes it is almost closed; at other times only droops slightly. The right lid has never drooped as bad as the left lid; in fact has never given any trouble only a few times at the beginning. It is much the stronger of the two eyes." (I quote from the patient's letters because they so clearly bring out the variability in the degree of the paresis.) "I can't give any exact dates of the trouble, because they have varied so much, and one day may appear so bad and much better the next. Reading by lamplight causes my eyes to feel weak and then the lid will droop until I close it for awhile. The difficulty in moving my eyes from side to side began right away after the first trouble. The right eye moved much farther than the left, and that made the double vision when they did not move together. I don't have double vision all the time, and near-sightedness is fast growing in my left eye. I can see much better looking to my right side than to my left. I can look down with both eyes moving together, but when I look up the right moves quicker and raises, and the left ball does not move as far upward as the right. None of my eye trouble has entirely disappeared, but all are very much better." (Miss A. R. S., Case 1, also thought she was better, but I could not confirm this on examination, and the better feeling is probably due to acquired freer head movements replacing those of the eyes.) "When my eyelids seem the strongest that doesn't make the movements of the eyes any easier. Yes, it was the left eye that turned in, but I don't think this occurred more than twice, for a period of two or three weeks, and at this time I almost looked to be cross-eyed (which would mean about as much as being blind to me)."

As Mr. Treacher Collins points out the abiotrophies of the external ocular muscles may be divided into several groups which must be distinguished from congenital defects of movement due to anatomical anomalies. There are (1) The facio-scapular humeral type, a family hereditary disease transmitted by either parent and affecting both sexes: The ocular defect is a paralysis of the orbicularis palpebrarum. (2) A type in which a bilateral progressive ptosis is the only symptom, beginning in early life and hereditary, or not appearing until an advanced adult age. The cases so far reported have been females. (3) Four generations of one family showing ophthalmoplegia externa beginning always in adult life. The levators were completely paralyzed and the recti have a very limited action; and (5) a series of cases whose onset was generally in infancy or early childhood,

sometimes later, and were characterized by an intermittent but slowly progressive paralysis of all the external ocular muscles generally ending after many years in their complete paralysis. Ptosis is usually the first and may long continue the only symptom.

Both of my cases appear to belong to the last group, but Case 1 has certain noteworthy characteristics. Thus, there is no ptosis and there never has been; her parents are unshakable in their stand that the condition of her eyes was congenital; and so far as I know no record has before been made of the effect of closure of one eye upon the latitude of movement of the other.

In Case 2 it will be observed that ptosis ushered in the trouble, and not until she had reached the adult age.

THE LAW OF ROTATION OF THE ASTIGMATIC AXIS.

By Dr. A. W. STIRLING, Atlanta, Ga.

THE "Rule" which is applied to the axis in astigmatism should apparently be supplanted or modified in favor of another which seems to be much more nearly worthy of the name. Instead of stating that the cylinder axis in hypermetropia is generally vertical and in myopia generally horizontal we should be nearer the truth if we said: "The axis of the correcting lens in hypermetropia tends with age to rotate from the vertical toward the horizontal, and in the opposite direction in myopia."

Two years ago I published a preliminary paper,[1] and in 1921 another[2] dealing with 544 eyes, which demonstrated clearly enough the above proposition. Thus taking the ages by decades the axes of the correcting cylinders more nearly horizontal than vertical in hypermetropia were in percentages: I, 0; II, 10.5; III, 11.6; IV, 23.1; V, 27.0; VI, 55.9; VII, 70.2; VIII, 76.6; IX, 100.0. In myopia the same percentages were: I, 100.0; II, 69.3; III, IV, and V combined 53.8; VI, 40.0; VII, 37.7; VIII, 0.

One must conclude from these figures that the cylinder axes have a strong tendency to rotate with age in the direction indicated.

I said in the latter of the previous articles, "another method of investigating the question of this axial rotation would be through the histories of the same eyes during long periods." This is the object of the present paper, founded upon a series

[1] "Astigmatism—Especially with Regard to the Influence of Age upon the Axis." *British Journal of Ophthalmology*, vol. iv., No. 2, Nov., 1920.

[2] Archives of Ophthalmology (New York), vol. l., No. 1, 1921.

of cases which have come up for examination during the last few months. All in this as in previous communications have been private cases. The method of procedure since beginning this last observation has been to mark down at the time of the examination the name of each and every patient with healthy eyes whose axis had changed since a previous examination. These I have since tabulated under a number of headings as will appear in the conclusions to be stated, but it would unnecessarily cumber these pages to reproduce in them a detailed statement of the figures.

Some of the cases had been under my care for many years, from 2 to 17, with an average of 7½ years.

The most important observation to be gleaned from a study of these tables of figures is that they emphatically endorse the conclusions previously arrived at by noting and comparing the positions of the cylinder axes at various ages. For (with the exception of three cases) every rotation is in accordance with the law already suggested that the cylinder axes tend to rotate toward a point which might be called the Position of Rest.

It is also worthy of note that the change of axis is gradual, and never by lengthy leaps and bounds. This I have observed as a general impression, and upon examination I find that for the thirty-nine cases recorded the average rotation in degrees for the right eye was seventeen and for the left nineteen. As the average interval between the first and last examinations was 6.4 years, we deduce an average annual rotation for the right eye of 2.7 degrees and for the left of practically 3 degrees.

In eleven of the cases one or more examinations had been made between the "first" and the last. These are worth quoting as they illustrate the gradual progression of the rotation. The axes of the following hypermetropic eyes varied thus in degrees at succeeding examinations:

Case V.	L.E.	90,	105,	135
Case VI.	R.E.	90,	105,	105
Case VIII.	L.E.	90,	75,	60
Case XIII.	R.E.	90,	105,	120
Case XX.	L.E.	70,	45,	15
Case XXIII.	R.E.	45,	30,	30
	L.E.	45,	45,	30

Case XXVIII.	L.E.	160, 120, 160, 165, 165, 180
	R.E.	(Constant at 120 during 13 years.)
Case XXX.	L.E.	90, 60, 30
Case XXXIV.	R.E.	75, 45, 20, 180
	L.E.	115, 165, 165, 180
Case XXXVIII.	L.E.	90, 105, 115
Mrs. L. C. K.	R.E.	When 44 years old at 90; when 45 at 100; when 46 at 120.
	L.E.	When 44 years old at 105; when 45 at 105; when 46 at 110. (This case came in for examination since this paper was completed and is not included in it.)

On examining old records I have observed the occasional apparent development of an astigmatism which was not discovered in the earlier examinations. The following is an example. Previous refractions were made 11, 9, 8, 7, 5, 4, and 2 years before on the eyes of Mrs. T. C. before astigmatism was found. There was only a mild degree of hypermetropia. Then the R.E. showed plus .25D. Cyl. axis 120 degrees. A year later the R.E. had plus .50D. at 150 degrees, and the L.E. plus .25D. at 120 degrees. Six years afterwards the R.E. had still plus .50D. at 150 degrees and the L.E. had plus .50D. at 150 degrees.

A considerable number of the cases were under observation for a period longer than that named as the interval between the first and last examination, the "first" actually meaning the examination previous to that at which a change of axis had been noted. Many of them, however, had already undergone one or more examinations in which the axis had been the same as that at the "first." This was true of 12 cases with an average of nearly two examinations each during an average of about four years previous to the "first" examination.

I had been of the opinion that it was rare for any change of axis to occur in young people, and taking age in decades my case figures show rotation to have begun in the following order: In Decade I, 0; II, 1; III, 3; IV, 6; V, 16; VI, 13.

Since completing this paper, Mr. J. M. has come in for examination, and though this case is not included in its figures

it is worth quoting as an example of the initial stages of the rotation:

At ages 41, 43, and 47 the axes of both hypermetropic lenses were at 120, at 49 (the present examination) the right was still at 120, but the left was at 135.

Experienced ophthalmologists are well aware that despite the greatest care errors are bound occasionally to creep into the results of examinations for refraction, and that not infrequently on account of inaccuracy of observation on the part of the patient. All that the writer can claim is an unvarying desire to give the best correction possible, stimulated by the observation that while there is little glory to be garnered in this sphere of work, taken all around it opens for us at least as much opportunity as any other for dealing out comfort or discomfort to our patients. If there are errors in these refractions they can hardly suffice to vitiate the general trend of the figures, and one might claim that they are more likely to be present where they seem to run counter to an apparent law rather than where they uphold it. That the glasses ordered at least gave better than what is called normal vision ($\frac{6}{6}$ is undoubtedly not up to the standard of normal vision) is proved by the following figures: the first examination gave for the 78 eyes 29 with $\frac{6}{4}$, 33 with $\frac{6}{5}$, 14 with $\frac{6}{6}$, 1 with $\frac{6}{7.5}$, 1 with $\frac{6}{9}$; the last examination gave 46 with $\frac{6}{4}$, 21 with $\frac{6}{5}$, 9 with $\frac{6}{6}$, 2 with $\frac{6}{7.5}$. The better results at the last examination are probably due to the fact that the illumination of the test types had been improved in the interval between at least some of the "first" and last examinations. (The figures $\frac{6}{4}$ and $\frac{6}{5}$, etc., do not always mean that the patient could read every letter of that line, but that his vision was more correctly indicated by them than by any other.)

The first case which is contrary to the general rule (Case XV) was a man of 43 at the first examination and 58 at the last. At both examinations the refraction of the right eye was plus .25D. Cyl. axis 145 degrees (down and out)—$\frac{1}{4}$, of the left at the first examination it was plus 1.75D. Cyl. axis 100 degrees—$\frac{1}{4}$ partly, at the last it was minus .25D. Sph. on plus 1.75D. Cyl. axis 90 degrees—$\frac{1}{4}$ partly.

The second was a lady of 39 at the first and 42 at the last examination. The right cylinder plus .75D. was at 180

at both examinations, and the left which was plus .75D. axis 180 degrees at the first examination had changed to plus .50 axis 150 at the last. Vision was $\frac{4}{4}$ at each examination.

The third was a lady 44 and 50 at the first two examinations which were identical and 53 at the last. The refraction of the right eye at the first was plus .50D. Sph. on plus .50D. Cyl. axis 105 degrees (down and out)— $\frac{4}{4}$, and of the left plus .50D. Sph. on plus .75 D. Cyl. axis 75 degrees (down and in)—$\frac{4}{8}$. At the last examination the right refraction was plus .75D. Sph. on plus .50D. Cyl. axis 80 degrees—$\frac{4}{4}$, and the left plus .75 D. Sph., on plus 1.0D. Cyl. axis 75 degrees—$\frac{4}{4}$. But at an intermediate examination two years before the last the right axis was 90 degrees, an interesting rotation (105, 90, 80) toward correspondence with the left which has been constant at 75 degrees.

Besides the change in axis the last examination showed differences from the "first" as follows:

Of the 78 eyes 60 had slightly altered. Of these changes 34 affected spheres alone (usually a slight increase in convexity), 13 cylinders alone, and 13 both spheres and cylinders. The convexity of cylinders was changed therefore in 26 or $\frac{1}{3}$ of the eyes. Of these the strength was decreased in six by an average of .33D. and the increase of the others averaged .27D.

My last article contained no direct argument bearing on the question of the constancy in the amount of astigmatism in individual eyes, but so far as they go the present figures show some tendency toward change, which is not surprising. Indeed it would perhaps be more remarkable did the amount always remain constant in eyes in which the axis changed.

This introduces the question of ætiology. In my last article I remarked on the fact that the rotation might be due to either cornea or lens, and mentioned that if it were corneal the cause might possibly lie in the force of the external ocular muscles exerted in such movements as those entailed in reading; while if it were lenticular the cause might be found in an irregular sclerosis of the lens, though it was hard to see why that should produce a rotation of the axis so commonly in one and the same direction.

Since writing the previous article it has occurred to me that a possible explanation might be found in a change in the zonule

permitting an alteration in the position, a tilt, of the lens, or in its form. Such a hypothesis does not appear absurd when one considers the constant rapid movement of the majority of eyes, and remembers that the zonule may undergo, and we know does at times undergo, a degeneration which weakens its fibers and perhaps not equally at all points.

The ophthalmometer would appear to supply the best means whereby one might separate corneal from lenticular astigmatism, and possibly someone who still makes a routine use of this instrument may be able to supply data which would help to settle the question. After using it for some years as an apparently necessary adjunct to a consulting room I long ago discarded it, and am therefore not in a position to compare the corneal with the total astigmatism in all the cases recorded in these articles. Theoretically the instrument should give precise results, but it has never been to me so minutely reliable that I would care in such a case as this where absolute accuracy is essential to make any definite statement founded upon its showings alone.

I have recently made with an ophthalmometer belonging to a friend an examination of some of the eyes considered in this paper, but so far I have been unable to find sufficiently reliable evidence upon which to found a decision on this aspect of the question.

METASTATIC THYROID TUMOR IN THE ORBIT.[1]

By Dr. ARNOLD KNAPP, New York.

(With two illustrations on Text-Plate I.)

COHNHEIM was the first to recognize that a struma may cause metastases, and called them metastatic benign strumas. These metastases occur in the bones and in the lungs. Why they seem to select the bones is unsettled; A. Muller believes that the medulla of the bone furnishes a favorable site for their growth because of its retarded circulation. Thyroid gland cells are unusual, in that they are capable after entering the circulation to remain viable, and in certain places proliferate and form tumors. Trauma plays here a definite rôle. Striking is the destructive power of these metastases, which is particularly evident in the bones. This destructive tendency, the formation of metastases, and recurrences, cause some authors to regard them as essentially malignant. The thyroid in some of these cases seemed perfectly normal. The tumor, may, of course, be overlooked in the thyroid gland.

Schmidt ("Zur Kasuistik und Statistik der Knochentumoren mit Schilddrüsenbau," *Inaug. Diss.*, Rostock, 1906) has collected 49 cases of struma metastases. In the metastasis, careful search reveals a carcinomatous part in the normal thyroid gland tissue. The site of these metastastic thyroid gland tumors is in various bones, particularly the cranial bones. Twenty-nine metastases occurred in the skull, principally in the frontal and parietal bones; in the vertebral bones, 16; in the ribs and shoulders, 4; in the pelvis, 11; in the femur, 7; in the humerus, 6. The size varies from that of a

[1] Read before International Congress of Ophthalmology, Washington, D. C., May, 1922.

ILLUSTRATING DR. KNAPP'S ARTICLE ON "METASTATIC THYROID TUMOR IN THE ORBIT"

FIG. 1

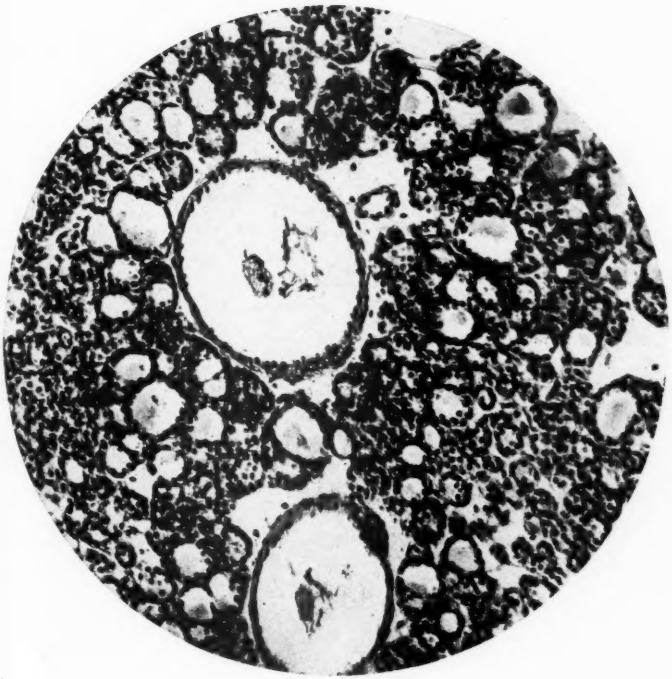

FIG. 2

fist to an egg. The age of the patient is between 30 and 60. It affects women more frequently than men. Trauma was elicited in 11. From the standpoint of the histology of the tumor and the clinical course, the struma metastases were malignant in 39, uncertain in 5, possibly benign in 5.

The following is an instance of this form of tumor:

CASE REPORT.—E. R. B., age 66, Dec. 18, 1917: Has always been in good health until recently. Has complained of vertigo and comes on account of discomfort in reading. Vision with glasses $\frac{20}{20}$. Both eyes seem unduly prominent. The right upper lid droops and the right eye is distinctly more prominent than the left. Exophthalmometer R. 32, L. 28. The motility of the right eye upwards is restricted, particularly in abduction (superior rectus). Distinct vertical diplopia, increasing upwards and to the right. This diplopia patient has observed for one week. On palpating the right upper orbital margin, there is a resistance to be felt, especially in the region of the pulley, which consists of a soft mass within the upper margin of orbit, occupying a round defect in the bone, where pulsation can be felt. The pulley is displaced. Optic nerve normal. Field normal. His physician Dr. Edward L. Partridge reports that the general examination is negative. The blood count is normal; hemoglobin 90%. The Wassermann test is negative.

The *Roentgen* examination shows (figure 1) an area of increased radiability on the right side, indicating an area of softening. It involves the orbital plate of the frontal and extends above the superciliary ridge. It is about three quarters of an inch in its widest diameter. It extends about one inch above the supra-orbital ridge and along the orbital plate to the sphenoidal fissure. There seems to be no involvement of the frontal sinus, but there is a supraorbital extension of the ethmoidal cells which seems to be very near indeed to this area of softening. With the exception mentioned, we find no indication of disease of any of the accessory nasal sinuses. The skull is unusually thick, especially the outer table of the frontal bone (H. M. Imboden).

Increasing doses of potassium iodide are prescribed for six weeks without any change in the tumor. An operation is advised.

Feb. 19th, '18, *operation*. Curved incision below the eyebrow down to the periosteum, which was found continuous downward with a mass. Incision made through the periosteum and the attempt was made to elevate it. It was so

firmly adherent to the underlying structure that this failed. The center of the mass seemed to be soft. The incision through the periosteum was then enlarged and immediately a dark hemorrhagic-like mass resembling granulation tissue presented. The area was fully exposed, some of the periosteum removed and the above-described material was scooped out. The cavity was found in the bone extending back, upward anteriorly and laterally. Profuse bleeding which made it difficult to see and one had to be guided by a sense of touch. After cleaning out all this soft material and some the rough bone along the margins, a rather well-defined cavity was exposed. The constant oozing was somewhat controlled by packing; it could then be seen that in two small places in the upper wall, the dura was exposed without being directly involved. The edges of the bony cavity were trimmed off and the entire cavity packed with iodoform gauze. The external wound was left open. Length of operation 1 hour.

In brief, this seemed to be a tumor arising in the medulla of the bone, particularly in the anterior part of the frontal, where it forms the upper wall of the orbit. The cavity was filled with soft, dark-red material. This in the lower part was directly adherent to the periosteum. A striking feature was the extensive bleeding which seemed to be general. The bony walls of the cavity were smooth.

No reaction followed the operation. At the first dressing some of the packing was removed; considerable oozing.

The specimen removed at operation was sent to Professor James Ewing, who reported as follows:

"The tumor (figure 2) of the bone in the case of E. R. B. proves to be an adenoma of aberrant thyroid tissue. It is rather orderly in structure and not very malignant, although in some spots the alveoli are small and numerous. It reproduces thyroid structure to the smallest detail, many alveoli containing soft acidophile colloid surrounded by flat thyroid cells. Many small alveoli are exactly similar to the usual thyroid adenoma. The stroma is scanty and not vascular.

"This tumor may arise from a portion of thyroid tissue originally present at that point in the embryo, or it may represent a metastasis of an adenoma in the thyroid. The thyroid gland should be examined for the presence of any small tumor at any point. I am inclined to prefer the

former hypothesis, especially if there is no tumor found in the thyroid.

"The prognosis of these cases is not entirely favorable. Although they have been called 'benign metastasizing struma' they are not always benign. They recur locally, and the only other case in the skull which I have seen (Jeffries' case, in parietal bone) recurred locally and eventually produced metastases elsewhere. The thyroid was normal. Hence I recommend that radium be inserted in the wound, as the alveoli penetrate the bone spaces and are hard to reach by the knife. I know of no cases treated by radium, but would expect this structure to respond well."

Feb. 24th, all of the packing is removed and a radium tube 27*mc* protected by a lead plate is introduced for four hours. The thyroid gland seems normal. Mar. 1st, no reaction, slight secretion superficially; wound is allowed to close.

April 1, '18. The wound healed. A swelling remained at the upper margin of the orbit continuous with a bony mass externally just above the external canthus. Some exophthalmos remains measuring R.30, L.28. Vision is normal. Eye ground normal.

Nov. 26, '18, general condition good: no change in orbit.

Apr. 8, '19, has lost about 30 lbs. in weight; complains of band over head and obscure abdominal symptoms.

July 1st, R.31.5, L.28. Diffuse swelling in orbit. Vision and eyeground normal.

Oct. 8th, drawing sensation in right half of head. R.32, L.28.

Dec. 19th, the orbital condition is unchanged. Diplopia to the right. Distinct soft pulsating mass in orbit. A swelling had been noted over right scapula for some months and patient complains of neuralgia in right groin.

On Dec. 29, '19, the patient is referred to Professor James Ewing, at the General Memorial Hospital who reports as follows:

"There is a tumor mass behind the eye which causes distinct exophthalmos and protrusion of the supraorbital tissues of about 1*cm*. The body of the right scapula is largely replaced by a tumor mass about 5*cm* in diameter, as shown by the X-ray. This tumor is of recent discovery and evidently grow-

ing actively. The left lower portion of the thyroid gland is the seat of a well circumscribed rather firm tumor mass about 4*cm* in diameter. There is pain in the use of the right thigh muscles, which was not investigated, but will receive attention later. The X-ray of the right lung shows several suspicious isolated nodules, which I suspect are tumor nodules, but which cannot be positively identified as such. Further X-ray photos of the lungs and bones will be taken. The patient has lost weight, is anemic and rather feeble, and is therefore distinctly cachectic. I feel that the prognosis is unfavorable, but that some help may come from X-ray and radium treatment.

"I would recommend that the tumor of the scapula be treated by X-ray, that the orbital growth be treated at first by a radium pack, and that the thyroid tumor be treated by the insertion of radium needles. This latter tumor is probably the source of the others. The scapular growth was treated this afternoon. We propose to go after the others slowly, but steadily, avoiding undue disturbance of the patient."

The shoulder tumor was given eleven X-ray treatments from Dec. 29, 1919, to May 18, 1920. A radiograph on Jan. 7, 1920, showed a destructive process in the VIIIth rib posteriorly and an area of bone destruction in pubis to right of symphysis. On Jan. 20, 1920, a small area of destruction was found in the VIth rib posteriorly. The right groin was treated by X-ray four times from Jan. 6 to May 4, 1920. Radiograph on Jan. 7, 1920, showed dense shadow above manubrium and, to the left of about the size of a small orange, indicating the presence of a calcified mass in the thyroid gland, pushing the trachea over to the right.

The orbit was treated with radium three times from Jan. 19, 1921, to Apr. 27, 1921.

The patient, according to Dr. R. W. Lowe, Ridgefield, Conn., then gradually lost weight, suffered from hallucinations and delusions, and was at times mildly maniacal. There was flatness over anterior and posterior chest (left); pleuritic pain, loss of motion over chest, dypsnœa, slight cough. Lymphatic enlargement in neck (left side). Œdema of lower extremities, increasing during last two weeks. Died July 21, '21, apparently from cerebral hemorrhage.

In this patient a tumor in the roof of the orbit was the first

symptom of a malignant process. At operation destruction of bone by a brownish granulating tissue-like mass was found present and unusually free hemorrhage occurred. The histology of the tumor showed it to be composed of thyroid gland tissue. No tumor could be detected in the thyroid gland on palpation. Symptoms of other metastases appeared one and a half years later and were confirmed by the X-ray examination in the scapula, in the VIth and VIIIth ribs, in the lungs and in the pubis, and at that time a distinct tumor was discovered in the thyroid gland, and the X-ray showed that it extended behind the sternum.

The localization of these thyroid gland tumors in the walls of the orbit is unusual. In the literature there is a report of a case by v. Eiselsberg (Langenbeck's *Archiv*, vol. xlvi., p. 440) of a woman 37 years old who showed externally a bulging nodule in the substance of the parietal bone, projecting inward and adherent to dura. Another nodule was situated in the right upper orbital wall extending through into the skull. The VIth rib right and the left humerus were also involved; struma present (adeno-carcinoma) autopsy report.

Jaboulay's patient (*Bull. Soc. de chirurgie de Lyon*, 1903), a female, 65 years old, presented a tumor in the superointernal angle of the left orbit, pulsating; old swelling of the thyroid gland. At operation the bone was found perforated, exposing the meninges.

In the discussion of v. Eiselsberg's report (*Verh. d.d.G. Chir.* 1893, p. 88 i.), Kraske said that he had observed a case where a tumor occurred in the frontal bone, the patient also having a struma. The association at first was not clear. At operation an unusual hemorrhage occurred, which is characteristic for this tumor. The tumor was adherent to the dura, necessitating excision of a part of this structure. The struma has remained stationary and no other metastases appeared. Microscopically the tumor resembled thyroid gland tissue and was regarded as an adenoma.

According to v. Eiselsberg (*ibid.*, p. 255, ii.), though the histological structure of the tumor suggested adenoma, the clinical picture is that of an adeno-carcinoma, because whenever a tumor metastasises, it becomes malignant.

The metastases of the adeno-carcinoma of the thyroid may

show normal thyroid adenomatous tissue. The metastases grow slowly, while the primary tumor in the thyroid is small and escapes detection. The bone metastases should be operated upon, v. Eiselsberg believes, though it is a general rule in surgery not to operate on bone metastases.

The primary tumor in the thyroid is often not found until the character of the metastases is made known.

BASAL CELL CARCINOMA OF THE ORBIT AND ETHMOID: OPERATION; RADIUM APPLICATION.[1]

By Dr. John Green, Jr., St. Louis, Mo.

CARCINOMA of the orbit by direct extension from primary malignant growths in the lacrimal glands, lids, and skin is not very rare, and a number of cases have been recorded in the literature. Much less frequent are cases of orbital carcinoma where metastasis has occurred through the blood-stream from a primary focus distant from the orbit. Finnoff [2] in a recent study was able to find only seventeen authentic examples of metastatic carcinoma of the orbit.

The case herewith presented belongs to the category of orbital carcinoma by direct extension. It is deemed worthy of record for the following reasons: (1) it presented an ophthalmological and surgical dilemma; (2) it illustrated a remote danger from the application of radium; (3) the procedure adopted, entirely justifiable from the strictly surgical standpoint, proved disastrous to the eye.

Case Report.—Mrs. M. T., age 53, came under my observation July 22, 1920, complaining of protusion of the left eye.

General History: One sister died of tuberculosis; mother dead (cause unknown, but she had tuberculous glands). No malignancy in the family.

The patient's general health has always been good. Has had measles, pertussis, pneumonia (3 years ago), rheumatism (?). Every spring and fall since the age of sixteen she has had a "breaking out" called erysipelas by some of her medical advisers. Is often dizzy and has smothering

[1] Read before the American Ophthalmological Society, May 1, 1922.

[2] Finnoff, Wm. C., *Trans. Am. Ophthalm. Society*, 1920.

spells. Three weeks ago had a left upper molar extracted, followed by chills and fever. Menopause four years ago. Two of four children are living.

General Examination.—The patient appears in fair health. Weight 131½; T. normal; pulse 88; heart, lungs, and abdomen normal. There is a slight œdema of the feet. Urinalysis, negative, except for epithelial cells and a few bacteria. B.P. 122–72. Hemoglobin 80%, clotting time 2½ minutes. Wassermann, negative.

Ocular History.—Fifteen years ago she noticed a swelling of the skin over the bridge of the nose. The physician first consulted called it "lupus." His treatment failing, the patient consulted an irregular practitioner who diagnosticated "cancer" and applied pastes. The lesion eventually healed (but only superficially as events proved).

Seven years ago she observed a small hard nodule at the left lower orbital margin. This increased in size very slowly for five years, but hardly at all during the past two years. There has been some aching and soreness behind the left eye. The protusion of the left globe was observed about five years ago.

Ocular Examination.—Right eye, highly myopic (over 20 D,—retinoscope). Staphyloma posticum. R.V., fingers at 1 meter (excentric). L.V. + .5 = $\frac{6}{6}$. L. Eye ground, normal.

There is a hard rounded growth 1*cm* in diameter, about the middle of the lower orbital margin. Just mesially is another smaller rounded nodule. On the bridge of the nose, just below the level of the eyebrows, is a typical "paste" scar which extends a few *mm* toward the left inner angle. There is, however, an island of normal skin between the scar and the caruncle.

The patient was referred to a rhinologist, Dr. C. F. Pfingsten, who reported that there was a slight bulging of the left lateral wall of the nose, and that the septum was deviated to the left. An X-ray picture (frontal) failed to disclose any abnormal condition in the orbit but did show a mottled or moth-eaten appearance of the left antrum. On puncturing the antral wall the trocar encountered firm (bony) resistance a few *mm* within the antral cavity. Provisional diagnosis: osteo-sarcoma of the antrum with secondary involvement of the orbit. The patient was referred to Dr. Ellis Fischel for surgical consultation.

In view of the uselessness of the right eye, it was difficult to decide whether any operation on the left orbit was justifiable, especially as the orbital growth had produced only slight exophthalmus (Exophthalmometer—R., 15½; L. 17) and there was no severe pain. It seemed to Dr. Fischel and

myself that an incision along the lower orbital border to permit the removal of a fragment of the nodule for microscopic examination was justifiable and would not imperil the globe. If a malignant orbital growth was found, it was decided to implant radium needles.

A detailed explanation of the surgical and ophthalmological quandary was made to the patient and she finally decided to submit to operation. This was performed August 4, 1920, by Dr. Ellis Fischel, to whom I am indebted for the following notes:

"A 1¼ inch" incision along the infraorbital ridge was carried down to the bone. The tumor mass in the floor of the orbit proved to be very thin bone, which had been broken through by a soft tumor growing below it. Small section of tumor, adherent to bone, reported (frozen section) "basal cell epithelioma." It was now judged that we were dealing with a very slow-growing malignant tumor, the original site of which was the bridge of the nose. In view of the clinical evidence and operative findings so far the antrum must be involved. One-half inch of the old scar on the bridge of the nose was deeply excised in order to substantiate the hypothesis of the origin of the trouble. Beneath this scar extensive tumor infiltration was found. The nasal process of the frontal bone was apparently infiltrated. The left antrum was widely opened through the canine fossa and a thorough digital and instrumental examination failed to discover any disease. A rounded bony mass covered by smooth mucous membrane projected from the mesial and superior walls of the antrum. This was judged to be an enlarged ethmoid cell. It was punctured and tumor masses similar to those in the orbit were removed by the curette. 62½*mgm* of radium in 5*mm* silver and 1*mm* rubber was placed in the ethmoid cavity; 12½*mgm* radium in gold needle was inserted into the tumor tissue in the wound in the orbit; two 12½*mgm* radium in gold needles were placed deeply in tumor tissue through the incision over the bridge of the nose. The skin incision was closed with six interrupted horse hair sutures. Rubber drain in orbit. Antrum packed loosely with iodoform gauze. Patient left the table in good condition.

The excised tissue from the bridge of the nose and the masses curetted from the ethmoid cells were submitted to a pathologist, Dr. George Ives, who reported typical basal cell carcinoma.

The radium needle was removed from the orbital wound at the end of eight hours = 100*mgm* hours. The needles in the nose and ethmoid were removed in 15 hours, a total of 1312½*mgm* hours.

The patient had a severe general reaction, the temperature reaching 104° on the second post-operative day, accompanied by delirium. The temperature did not reach normal until the tenth post-operative day. August 10th; free purulent discharge from wound of orbit and much swelling over the left antrum. This diminished after insertion of gauze drain. August 13th; there is much œdema of the eyelids. The eye can be inspected and, save for conjunctival congestion, looks normal. Mobility impaired downward. Accurate visual test impossible, but patient counts fingers at 12 ft. Ophthalmoscope, media clear; fundus normal. August 14th; the patient was permitted to return to her home in the country, and placed in the care of the family physician. Nothing more was heard of her until August 28th, when her physician telephoned that she was very ill with erysipelas. December 4th, the patient's husband wrote that his wife could not see out of her left eye, that the eye "seemed to be lost."

She did not appear in St. Louis until January 28, 1921. She stated that following the attack of erysipelas there was infection and discharge, and pieces of bone came out. Now complains of pain in the left superior maxilla and discharge into the nose and mouth. There is considerable œdema of the lids. Left eye, phthisis bulbi. V. = O. Below inner canthus is a smooth opening into the antrum which contains loose sequestra. There is another opening in the canine fossa. February 3, 1921; a large sequestrum in the ethmoid region was removed. The orbito-antral opening continues to discharge sequestra. The patient's weight has dropped to 114. There is no evidence of tumor tissue anywhere.

She was instructed to return in six weeks but failed to do so. A letter (March 18, 1922) to her physician elicited the simple statement that she was "better."

The sequence of pathological events seems reasonably clear. A malignant growth originating in the skin over the bridge of the nose healed superficially, but tumor cells infiltrated the nasal process of the frontal bone and finally involved the ethmoid. It is reasonable to suppose that the orbit was involved from the ethmoid cells, although the possibility of subcutaneous extension directly from the site of the original lesion on the bridge of the nose may also be considered.

Was the radium implanted in the orbit directly responsible for the loss of the eye? I believe that one can safely answer this question in the negative. The total *mgm* hours of all the

radium implantation amounted to 1412½ of which only 100 *mgm* hours were used in the orbit. It is well known that the cornea and sclera are particularly resistant to radium emanations. In the treatment of cancers of the lid much heavier doses have been given without screening (300*mgm* hours or more) without damage to the globe, although lashes have been lost and conjunctivitis, with œdema of the lids, has ensued. In the treatment of malignant growths of the antrum a dosage as high as 2400*mgm* hours has been given without detriment to the eye.

There can be no question that the radium implanted in the orbit led to destruction of tumor tissue, leaving an open wound which became infected. At the time the patient left the hospital this infection was well under control. Later a severe type of infection, probably streptococcal, led to necrosis of bone, erosion of the sclera, perforation of the globe, and phthisis bulbi.

A CASE OF EPIBULBAR MELANOTIC SARCOMA, OCCURRING SIXTEEN YEARS AFTER AN INJURY.

By Drs. JAMES MOORES BALL and HARVEY D. LAMB, of St. Louis.

(*With two illustrations on Text-Plate II.*)

EPIBULBAR pigmented sarcomata, situated at the limbus, are of such rarity as to justify this report. Mr. J. G. Clegg and Dr. I. W. Hall, of Manchester, England (*The Lancet*, Sept. 10, 1904), say:

"Holmes found three cases during the examination of 20,000 eye cases; Noyes observed three melanotic sarcomata amongst 70,000 eye patients; Adamück mentions the occurrence of similar pigmented growths in three out of 16,000 eye cases; Verhoeff and Loring report two such tumors which were met with during the routine examination of 44,719 eye patients, while amongst the 520,523 out-patients who have attended at the Manchester Royal Eye Hospital during the last 33 years, three cases of pure melanotic sarcoma of the limbus have been recorded, although general 'orbital melanosis' has been frequently noted."

The case to be described is the first undoubted one (*i.e.*, verified by microscopic examination) of its kind which the writers have observed.

Mr. R. B., aged 33 years, a farmer, was brought to Dr. Ball by Dr. W. J. Whitefort, of St. Elmo, Ill., on April 19, 1921.

About sixteen years ago Mr. B.'s left eye was struck by an iceball. Following the injury there remained a brown spot situated on the temporal side of the sclera. This spot did not disappear. It remained small and gave no trouble until

ILLUSTRATING DR. JAMES MOORES BALL'S AND DR. HARVEY D. LAMB'S ARTICLE ON "A CASE OF EPIBULBAR MELANOTIC SARCOMA OCCURRING SIXTEEN YEARS AFTER AN INJURY."

FIG. 1.—Epibulbar Melanosarcoma with Adjoining Portion of Eyeball. Magnified 5 x.

C—Cornea; S—Sclera; I—Iris; E—External rectus muscle; N—Neoplasm; D—Darker-staining tip; H—Hemorrhage; T—Cellular infiltration.

FIG. 2.—Epibulbar Melanosarcoma with Adjoining Portion of Cornea. Magnified 100 x.

A—Anterior epithelium of cornea; D—Bowman's membrane; S—Substantia propria of cornea; C—Covering epithelium of growth; T—Round cells of sarcoma; M—Pigmented portion of the growth.

six months ago, when it began to enlarge and to grow rapidly.

Six weeks ago the growth was cut from the globe by Dr. C. A. Higinbotom, of Vandalia, Ill. Removal was followed by immediate recurrence, until now the new mass is as large as was the one removed. Occupying the corneo-scleral region on the temporal side of the left eye is a dark-brown, elastic mass measuring from 9 to 12 millimetres vertically; from 13.5 to 16*mm* horizontally; and reaching a height of 6*mm*.

Vision of R.E. $\frac{20}{10}$; of L.E. $\frac{20}{15}$. The fundi are normal.

Diagnosis.—Epibulbar Melanotic Sarcoma.

(Patient refused to permit the removal of a small piece of the tumor for microscopic examination.)

Treatment.—On April 20, 1921, the eye was enucleated. Up to date (July 1, 1922), there has not been any sign of recurrence.

Pathologic Report.—(Dr. H. D. Lamb). One-half the eye-ball with its growth was fixed in formalin, imbedded in celloidin, and the sections were stained with hemotoxylin and eosin.

On section (Fig. 1) at its middle the growth is seen to extend about three times as far onto the sclera as on the cornea. Thickest at or just behind the limbus, the tumor as we follow it forward onto the cornea diminishes but little in thickness, while posteriorly, the thickness becomes uniformly and rapidly less.

The tissue of the growth is seen to be stained quite uniformly bluish and is quite sharply differentiated from the adjoining red staining cornea and sclera.

Microscopic Findings.—The ocular tissues, with the exception of the growth itself, and the immediate adjoining structures, show no apparent changes.

The tumor-mass (Fig. 1) while it lies directly in apposition to the cornea and to the sclera just behind the limbus on which it lies, posteriorly leaves the sclera, being separated from it by some very loose connective tissue. The posterior tip of the growth lies free, separated on its underside from the eye-ball by epithelium which is continuous with that of the bulbar conjunctiva.

Surface views of the sections (Fig. 2) show nuclei in great profusion, mingled with which there is a moderate amount of dark-brown pigment. Strands of connective tissue can be made out in many places; at the corneal end of the tumor there is much connective tissue in thick strands, but in the remaining five-sixths of the section-length it occurs in very fine bands along which in many places clumps of pigment

are grouped. Indeed, in many places these pigmented connective tissue lines form a well-marked alveolar arrangement.

The nuclei of the tumor cells are quite large, round or oval-shaped. They stain generally rather faintly and show a distinct nucleolus. In most places no intercellular tissue can be made out. The pigment is very irregularly arranged, occurring in amounts from the thinnest particles to large opaque clumps. It is in the cells, between them, but for the most part along the band of connective tissue. Blood-vessels are very scarce in the tumor, except at the ends of the growth and in the parts adjoining the sclera. The posterior fourth of the neoplasm (Fig. 1) is strangely different from the adjoining anterior portion. There is a rather sharp line of demarcation, the posterior part appearing considerably bluer in color, due, of course, to the nuclei there taking the hemotoxylin stain better. There is very little pigment present in this posterior portion, while immediately anterior beyond the line of demarcation there is considerable pigment. What is the explanation for this appearance?

The covering epithelium (Fig. 2), continuous with the anterior corneal epithelium, is of a varying thickness changing gradually from three or four layers to as many as ten or twelve layers of cells. This tumor epithelium is chiefly distinguished from the corneal epithelium (Fig. 2) in being made up of layers of flattened epithelium for about three-fourths of its thickness. There are, however, no keratinized layers present.

The effect of the growth upon the immediate adjoining structures is surprisingly little. There is a small amount of infiltration of mostly polymorphonuclear leucocytes, but also some large lymphocytes, between the corneal lamellæ beneath the growth. In several places these are well marked, appearing as thin linear infiltrations. There is no epithelium between the growth and the cornea, but Bowman's membrane (Fig. 2) is absolutely intact throughout its length, and no sarcoma cells can be seen interior to it. Beyond the end of Bowman's membrane posteriorly, there is a gradual thickening of the cornea and sclera (Fig. 1), which reaches its highest point just opposite the thickest part of the ciliary muscle. This thickening is due to new lamellæ of connective tissue formed on the outer part of the sclera, no doubt as a protective measure against the tumor. On the margin of the tumor, adjoining the sclera, there is a rather general infiltration with polymorphonuclear leucocytes and large lymphocytes. This infiltration is well-marked about the vessels and on the inner edge of the growth; just after it has left the proximity of

the sclera the infiltration becomes intense for a few millimetres, and extends quite a distance outward among the sarcoma-cells. There is also considerable cellular infiltration in the epithelium of the bulbar conjunctiva beneath the posterior tip of the neoplasm.

REMARKS.

While most epibulbar melanotic sarcomata have been met with in late middle or advanced life, at least three cases have been observed in children aged 8, 11, and 14 years respectively.

As ætiologic factors traumatism, irritation, and congenital ocular melanosis have been mentioned. The important question as regards epibulbar sarcomata concerns their degree of malignancy. Early removal of the growth, with cauterization of the affected area, may suffice to effect a cure. The patient should be warned, however, of the possibility of a recurrence, and should be kept under observation for a prolonged period.

The question of malignancy in epibulbar sarcomata was studied by Verhoeff and Loring (ARCHIVES OF OPHTHALMOLOGY, March, 1903). In their analysis of 73 cases they state that in 53 cases, in which primary abscission was done, recurrence followed in 36 of the patients; the growth reappearing within one year in 10, within two years in 3, and in the remainder within a period of six to ten years or more. Metastatic nodules were observed in 7 cases, while in 5 others nodules also appeared in the orbit or on the lids. Of 19 cases in which primary enucleation was performed, the interior of the eye was involved in 3 cases, while in 3 other cases there were general metastases in the internal organs.

REPORT OF THE TRANSACTIONS OF THE OPHTHALMOLOGICAL SECTION OF THE ROYAL SOCIETY OF MEDICINE.

By Mr. H. Dickinson, London.

The first meeting of the Session was held on October 13th, the new President, Mr. A. L. Whitehead (of Leeds), occupying the Chair.

Cases.

Dr. Rayner Batten showed a man with **calcareous degeneration and a deposit on the iris.** When two years of age the right eye was injured, and the lens appeared to have been absorbed.

Dr. J. A. Valentine showed a case of *cyst of the retina, the* patient being a woman 26 years of age. She had never been out of Portsmouth. Eighteen months ago she noticed a line moving in front of the right eye. She was found to have 2D. myopic astigmatism, and the axis was down and out 15°. At first he thought of the possibility of it being cysticercus, but no confirmation of that view could be obtained.

Mr. Treacher Collins agreed with the diagnosis, and commented on the rarity with which such was seen ophthalmoscopically, though the discovery was common in pathological specimens. One such case he saw, and it was regarded as gliomatous and the eye excised, the actual condition being revealed afterwards.

Mr. Valentine, in reply, said one member expressed to him the view that it might be tuberculous disease of the choroid, and that was supported by there being a similar shaped white area two disks distance lower down.

Mr. Williamson-Noble showed a patient with **angioid**

streaks in the retina. The only positive result in the investigation of the case was that the patient's complement-fixation reaction to tubercle was positive.

He also exhibited and demonstrated a plane glass retinoscope, for use without a mydriatic. It consisted of two tubes, placed at an angle of 30°; and where these joined a piece of plane glass was placed, mounted on screws to allow of adjustment. At the far end of the tube was a 30-candle power light. Projecting from the casing was a tube containing a 20D. convex lens. A stop was placed between the lamp and the lens, and another stop beyond the lens. The glass was so arranged that a beam of light was projected down the center of the tube, at one end of which the patient was seated. Refractions could be easily determined by it, especially low degrees of astigmatism.

THE PRESIDENT considered the instrument a very ingenious one, and there were great possibilities before it, particularly when further improvements suggested had been incorporated.

The President's Address.

Mr. WHITEHEAD then delivered his Presidential Address. After expressing his warm appreciation of the high honor accorded to him, he referred to the recognition of the speciality by his Majesty in conferring knighthoods on Sir John Parsons and Sir Richard Cruise. He had a sympathetic word for the loss by death of Edward Stack, of Bristol, and Charles Wray, of Croydon.

He devoted his address to a consideration of the subject of ocular tuberculosis. Tuberculosis was more frequent in Leeds and less frequent in the West Riding of Yorkshire than in England and Wales as a whole. England and Wales as a whole had a tuberculosis case-rate of 2.07, the lowest since 1914; that for the West Riding was 1.61. The case-rate for Leeds was 2.61. Tubercular lesions of the eye were very rare in pulmonary tuberculosis, but if cases of ocular tuberculosis were followed up it was often found that other manifestations were present. In 1921 Igersheimer and Prinz published a paper giving the results of following up 92 scrofulous eye cases for 10 to 30 years. In 13.9% there were changes in the lungs,

and 13% had symptoms of active tuberculosis. Mr. Whitehead considered there was an important difference between the severe spreading invasions of the eye, leading to more or less complete destruction of the eyeball, and the more chronic and benign forms of tuberculous infiltration: in the former typical giant cells and tubercle bacilli were frequently found, but in the latter there was usually failure to demonstrate them. In these it was believed the infection was due to a tuberculotoxin acting on a specially prepared area. Miliary tubercles of the choroid in acute tuberculosis of infants were frequently present: in most of the fatal cases of tubercular meningitis he had examined he had found miliary tubercles. These tubercles occurred in the same class of individuals as those having the less severe forms of tuberculous infection of the eye. They were a third to half the size of the optic disk, grayish-yellow, with a soft indefinite margin; later the circular clean-cut edges of the atrophic patch were very characteristic. Usually they were not recognized until a later age when vision is interfered with.

He had not seen primary tubercle of the retina, but he had one case of what he regarded as a nodule in the papilla of tuberculous nature. Degenerative changes in vessels followed by hemorrhages, sometimes into the vitreous, had been described, and he had experience of two cases in which vitreous hemorrhages preceded other evidences of general tubercular infection, and in those patients pulmonary tuberculosis occurred 12 to 18 months after the appearance of the hemorrhages. Possibly some of the unexplained cases of recurrent vitreous hemorrhage might be due to toxin infection from a tuberculous focus elsewhere in the body. Schieck especially had reported favorably on the use of tuberculin in recurrent retinal hemorrhages.

Dealing with tubercular iritis, he said that in many of the milder cases of this condition the nodules were small, they disappeared early, and left but little permanent change in the iris structure. The subjects were usually young and apparently robust females, with no other evidence of tuberculosis, but with a family history of susceptibility to the infection. In these cases tuberculin treatment, in proper dosage, had been frequently of value. Hessberg considered that more than half

of all cases of iritis were attributable to tuberculosis. Phthisis and joint tuberculosis seldom co-existed, but frequently the lymphatic glands of mesentery and mediastinum were affected. In the view of most ophthalmologists the percentage given by Hessberg was much too high. Involvement of the lacrimal sac by the disease did not seem to be common, but he had seen it secondary to polypus of the nose and as an extension of tubercle of the ethmoid. An epiphora might develop secondary to nasal tuberculosis; in one such case it followed tuberculous ulceration of the inferior turbinate. This patient, a girl of 12, also had tuberculous ulceration of the vulva, which was cured by local and general treatment. A year later her toe was amputated for tubercular dactylitis, and then the nose and lacrimal sac were affected, and later still the pharynx and larynx. During the five years these successive lesions had been developing the child had maintained a very healthy look.

In tubercular conjunctivitis the large sub-epithelial nodules leading to ulceration and large granulations were rare.

With regard to the possible tubercular origin of the common phlyctenular conjunctivitis of children, Veeder and Hempelmann reported, in 1920, 196 cases of phlyctenular disease, and 93 of them gave a positive von Pirquet reaction. In half the cases, tuberculous lesions were found in other organs, and of those kept under observation for a year or more, four-fifths gave evidence of other tuberculous processes. The President had noticed a type of phlyctenular conjunctivitis which he had come to regard as definitely tubercular. Occurring mostly in young adults, it was a very chronic type, and resistant to ordinary treatment. The phlyctenules were small and closely set, near the corneoscleral junction, and there was frequently infiltration of the cornea, with invading vessels. Ulceration was very rare. Iritis was sometimes present also. In all the cases there were evidences of tubercular process elsewhere or there was a family history of susceptibility to the disease. Examination of the tissue and inoculation gave negative results. Immediate and striking benefit followed the use of tuberculin in these cases. Tuberculin B.E. was used, and the initial dose was 1.5,000*mg* to 1.10,000*mg*, according to age.

Four-hourly temperature records were taken for 24 hours with the patient in bed. Failing a general reaction or temperature, an increased dose was given three days later. When the reaction was obtained the dose was repeated, and if there was again a reaction, the dose short of this was given, and repeated at weekly or fortnightly intervals, according to the case. He had not had any experience of direct local applications of various dilutions of tuberculin P.T.O. (bovine). Constitutional treatment was of great importance, as also was the searching for and treating any local focus of the disease.

With regard to the possibility of the mediastinal glands being the primary focus in cases of toxin infection of the eye, Professor Stewart had supplied him with some important observations. In 100 cases of death from rapidly-fatal war injuries on men of good physique, there was evidence of tubercular disease in 42%, in 11% scarring at the apices of the lungs, and in 1% extensive old pleuritic adhesions. In 32 of the 100 there were signs of glandular infection; hence it seemed the primary focus in these cases of tuberculo-toxin might be the bronchial and other glands. Excision of the affected conjunctiva in some cases was tried, but without specially satisfactory results. The best results seemed to follow if a strip of conjunctiva 2 or 3*mm* in width were excised all round the corneo-scleral junction, and the larger superficial vessels involving the cornea carefully scarified by the point of a Graefe knife. The value of peritomy had been emphasized by several ophthalmic surgeons, and he believed it to be one of the most valuable aids extant.

Tubercular keratitis following infection after injury he regarded as rare, as also was secondary infection from the conjunctiva, the ciliary body, or the iris. In his experience, peritomy was of the greatest value in the treatment of the pannus of tubercular keratitis, though it was valueless in congenital syphilitic keratitis; but the possibility of a mixed infection must always be remembered.

Mr. N. Bishop Harman read a paper entitled "Standards of Vision for Scholars and Teachers in Council Schools." He said the teacher's life was, in his view, a hard one, and short

hours and good holidays did not ensure against risk of strain to normal eyes. This risk was increased in cases having an ocular defect. The teacher's work, of course, was not limited to the energy expended in the class-room, as there was much preparation to be carried out. In schools worthy the name there was also a large social element, the organization of which fell to the teachers in State schools, for here there were no officials such as prefects.

The State had provided an "Educational ladder," rungs of which were scholarships, college, university training. It was a necessary corollary of this provision that the recipient of these advantages should have the physique to enable him or her to benefit by them. The absence of such physique meant wastage, and the physical failures probably kept out better candidates. There were tests of vision in existence, but there was a real need for these tests to be standardized. Otherwise a teacher trained in one area might be refused in another, an undesirable anomaly. Trained teachers should be freely interchangeable, as they would with an uniform standard, and this free movement engendered breadth of view and added experience.

Junior scholarships were awarded at the age of 11 years, and provided for five years at a secondary school. Senior scholarships were awarded at 16 years of age, and gave four years at a University. The training college was entered at the age of 16, and teachers were admitted to their work at 21.

Recently the author had adduced evidence of the disability due to defective vision in myopes. It was found in that investigation that myopes of 3D. to 5D. who were engaged in continuous close work showed failure in work to the extent of 33%; those from 5D. to 10D. to the extent of 60%, and those over 10D. to 77%. The whole of these myopes showed a failure of 53%; whereas myopes of the same order who did not engage in continuous close work failed only to the extent of 9.4%. On this basis, the author had worked out a table of standards, which he now submitted to the Section for consideration and discussion. Starting with the allowable margin of error in teachers at the age of 21, the difference was estimated for the children at the age of 11.

TABLE OF STANDARDS

(*a*) Hypermetropia

Candidates	*Age*	*Sphere*	*Cylinder*	*Sphero-cylinder*
All	11–21	5D.	4D.	Average of four meridians = 5; as. not over 3D., *e.g.*, + 3·5D. sph. c. + 3D. cyl.

(*b*) Myopia, with Mixed Astigmatism.

Teacherships	21	5D.	4D.	As in hypermetropia
Senior Scholars	16	4D.	3D.	Average of four meridians = 4. As. not over 3D., *e.g.*, − 3D. sph. c. − 2D. cyl.
Junior Scholars	11	3D.	3D.	Average = 3D., As. 2D., *e.g.* − 2D. sph. c. − 2D. cyl.

Mr. Harman had given consideration to a number of possible defects due to odd eyes, old inflammations resulting in scarred eyes, etc., also amblyopia from squint and defects of color vision.

Difficulty might sometimes arise in the disbarring of young myopes who were alleged by their teachers to be "brilliant," but these reports should not be considered too seriously. Myopes devoted an undue amount of time to close work because the defect of sight presented a handicap in games, yet the all-round candidate with better sight might be the better in the long-run. The 2D. difference between teacher and junior scholar in the allowable degree of myopia was none too much for ten years of hard study between the 11th and the 21st years, which were also the most critical years of development. In such cases it was better, in the interests of both the candidates and the teaching service, to divert their energies to safer channels at an early age. There were now trade scholarships, entailing but little strain on the eyes.

Mr. ERNEST CLARKE agreed that lamentable mistakes had arisen through various County Authorities having different standards of vision and fitness for their candidates. It would be a difficult matter to devise a standard of universal application; one child with more than 3D. of myopia might be puny

and narrow-chested, with no liking for games, while another, with a like degree, might be robust and one who indulged in out-of-door games. Much must hinge on the previous personal history, and there should be records kept of each child, so that the examiner would know whether the myopia was progressive. And it would be extraordinarily difficult to set a standard for hypermetropia; in those cases it was the small errors of astigmatism which would count, because those with big errors would take care of themselves. Some people seemed to be born teachers, and it seemed a pity to exclude them from that profession. Much must depend upon supply and demand; if many candidates were available, the standard could be kept high, but if the converse were the case, it would have to be lowered.

Mr. INGLIS POLLOCK spoke of the methods in use at Glasgow. If a child was found to have increasing myopia, it was open for the examiner to admit him, but with the proviso that he could not participate in the Superannuation scheme.

Mr. T. HARRISON BUTLER pleaded for discretion to be vested in the examiner. To express an opinion on a case of myopia in this connection, one should see the child for two years. Myopic children had a natural tendency towards learning, and he contended that progressive myopia had no connection with following near work. It would be undesirable to allow an unproved theory to influence legislation.

Dr. F. C. SHRUBSALL spoke from the standpoint of the school medical officer. He welcomed such a contribution as Mr. Harman's if it led to a general consensus of opinion, as sometimes the opinion given by the school medical officer was overridden by a letter from a specialist. Candidates should be told of their unsuitability before commencing the study, not after studying four years.

In the end, the subject was referred to the Council of British Ophthalmologists, with a request that they would try to devise an uniform standard.

REPORT ON THE PROGRESS OF OPHTHALMOLOGY.

Abstracts by Drs. A. N. Alling, New Haven; M. J. Schoenberg, New York; T. H. Butler, London; P. G. Doyne, London; and K. Wessely (*Archiv f. Augenheilkunde*), Würzburg.

Edited by Matthias Lanckton Foster, M.D., F.A.C.S., New Rochelle, N. Y.

(*Concluded from November number.*)

XI.—THE LENS.

72. Albright, G. C. **Subconjunctival dislocation of the crystalline lens.** *American Journal of Ophthalmology*, August, 1921.

73. Cridland, B. **The occurrence of glass-workers' cataract in puddlers (iron-smelters).** *British Journal of Ophthalmology*, May, 1921.

74. Fischer, M. A. **A case of cataract formation in consequence of starvation œdema.** *Med. Klin.*, 1920, p. 924.

75. Green, A. S., and Luna, R. P. **The Barraquer intracapsular cataract operation.** *American Journal of Ophthalmology*, August, 1921.

76. Healy, J. **The prevalence of lenticular opacities in the eyes of tin-plate millmen.** *British Journal of Ophthalmology*, May, 1921.

77. Parker, W. R. **Senile cataract extraction.** *American Journal of Ophthalmology*, September, 1921.

78. Roberts, B. H. St. Clair. **A series of cases of glass-blowers cataract occurring in chain-makers.** *British Journal of Ophthalmology*, May, 1921.

79. Van Duyse, D., and Danis, M. **Typical siderosis of crystalline lens. No clinical evidence of a splinter of iron.** *American Journal of Ophthalmology*, August, 1921.

80. Ziegler, S. L. **Complete discission of the lens by the V-shaped method.** *Journal of the A. M. A.*, October 1, 1921.

Albright (72, **Subconjunctival dislocation of the crystalline lens**) reports the case of an elderly lady, who as a result of traumatism had a dislocated cataractous lens under the conjunctiva. After four years, as the result of a slight injury, the lens was extruded through the conjunctiva and remained in the fornix until removed ten days later. Alling.

Much attention of late years has been given to industrial disease. Many pathological states have been found to be due directly to the conditions under which certain trades are carried on. Miners' nystagmus and glass-blowers' cataract are now recognized under the Workman's Compensation Act of Great Britain.

It has long been suspected that other occupations, in which the men are exposed to molten substances, may cause cataract and should be included in the Act.

In the May number of the *British Journal of Ophthalmology* there are three papers describing lenticular changes, similar in appearance to those occurring in "glass-blowers," which have been found in iron-smelters, tin-plate millmen, and chain-makers.

Taking the papers in order: CRIDLAND (73, **The occurrence of glass-workers' cataract in puddlers**) describes the occurrence of typical glass-blowers-cataract in iron-smelters. The condition is not common, only 2–3 cases being seen a year, but "puddling" does not require many men and steel is coming more and more into use in place of "puddled" iron. The appearance of the cataract in "puddlers" is identical with that seen in glass-blowers, namely: a round posterior cortical opacity.

HEALY (76, **Lenticular opacities in the eyes of tin-plate millmen**) deals with lenticular opacities in tin plate millmen. Healy's attention was first drawn to this condition by the number of cases of cataract occurring in tin-plate workers, the men themselves being under the impression that cataract is very rife amongst themselves, and in the second place by the fact that clinically the lens changes in these men appeared very similar to those occurring in glass-blowers.

Particular points regarding the work of these men are that they work in 8 hour shifts, that they are continually exposed to molten metal at a distance varying from 2 to 5 feet from the eyes, that the work is heavy and the heat great so that the men perspire freely and in consequence drink a great deal, usually beer or tea, that the men are not square to their work so that the eyes are unequally exposed, and that the ultra-violet rays in tin-plate mills are negligible. From the statistics reported it appears that it takes upwards of 15 years in this occupation to produce the lens changes.

Of the men examined:

Group 35–40 years	16.5	per cent. affected
Group 40–45 years	18	per cent. affected
Group 45–50 years	34	per cent. affected
Group 51–55 years	62	per cent. affected
Group 56–60 years	64	per cent. affected

The usual age at which this work is taken up and the eyes become exposed is 18–20 years.

The character of the opacity differed from that seen in glass-blowers inasmuch as the commonest appearance was a wedge shaped striated cortical opacity below with its apex upwards and growing into the posterior cortex. This was by far the commonest appearance and was seen in 50 per cent. of the cases. The next most common appearance however was the round posterior cortical opacity, similar to that in glass-blowers. This occurred in 10 per cent. of the cases. In some cases both forms occurred together.

Healy is of the opinion from his own experience and from the statements of the workmen that the cataract is of very slow growth.

In reviewing the clinical facts which he has produced, Healy contends that the incidence of cataract among tin-plate workers is definitely raised as compared with the normal incidence.

It has been debated as to whether the ultra-violet or the infra-red rays are the causative agent of glass-blowers' cataract and it has been more generally held that it is the infra-red rays which are to blame; but against this view it was advanced that no record of cataract amongst iron workers had been produced. Healy's figures supply this deficiency.

Regarding the pathology of this condition Healy suggests that:

1. The heat rays cause at first an increased growth of lens fibers and later an exhaustion of this process at the time when sclerosis and shrinking of the nucleus is occurring.

2. The effect of the heat rays on the iris and ciliary body and the resulting aqueous and so on the nutrition of the lens.

ROBERTS (78, **Glass-blowers' cataract in chain-makers**) reports and describes a series of cases of "glass-blowers' cataract" occurring in chain-makers.

Chain is made by hand. The rolled iron rod is heated and bent into the shape of a link; the two ends in apposition are then heated to a white heat and welded together to complete the link by being hammered on an anvil.

The workers are therefore looking either at the furnace or at the white hot metal for the whole of their working day.

The usual age of onset is between 40–50 years, so that, as in the tin-plate workers, it takes 15–20 years to produce the condition.

In all cases the opacity was a posterior polar and cortical one but in some of the cases there was also a small anterior cortical opacity.

P. G. DOYNE.

The paper of GREEN and LUNA (75, **The Barraquer intracapsular cataract operation**) records the impressions of a visit to the clinic of Professor Barraquer. The latest device consists of a special electric motor which creates a vacuum in the small cup which adheres to the lens and at the same time transmits fine vibrations which are thought to assist in the rupture of the zonula. The operation is still in the experimental stage but it seems likely to become extensively employed.

ALLING.

FISCHER (74, **Cataract formation in consequence of starvation œdema**) reports the case of an iron worker 31 years old in whom bilateral cataracts formed within three months. This was in March, 1920. In April, 1919, he had suffered from starvation, with emaciation, bradycardia, polyuria, and œdema varying in degree. There were no signs of tetany. The urine contained no albumin, sugar, or indican. His occupation as a iron worker seemed to have no connection with the formation of cataract. In the absence of all signs of disease of the eyeball, general disease, or metabolic disturbances, and in the absence of demonstrable disturbances of the endocrine glands, the author thinks the starvation œdema must be looked upon as the cause of the formation of cataract.

PARKER (77, **Senile cataract extraction**) reports on 1421 cataract extractions in private practice and in the clinic of the University of Michigan during the last sixteen years. There were 1013 combined, 156 simple, 49 Knapp, 91 Indian, 141 after preliminary iridectomy, and 8 after trephine for glaucoma.

Loss of vitreous occurred in 10.1%, the Indian operation giving the greatest percentage. Infection is recorded as 0.7%. There were three cases of expulsive hemorrhage and 3% of post-operative delirium. The author's experience with the Indian operation has led him to the conclusion that it is not as safe as the older methods. ALLING.

The eye described by VAN DUYSE and DANIS (79, **Siderosis of lens with no other evidence of a splinter of iron**) was injured, about two years before the examination, by a piece of steel. The lens was cataractous and showed nine yellowish-brown spots in the anterior cortex just under the anterior capsule. There were also numerous fine dots of russet color. Small pigment corpuscles of darker color were scattered on the anterior capsule. These may have been congenital or due to blood pigment. The supposition is that a small piece of steel penetrated the eye at the limbus, leaving no wound when passing through the periphery of the iris and lodged in the lens. In time it became oxidized and disintegrated so that the X-ray, sideroscope, and magnet gave negative results.

ALLING.

ZIEGLER (80, **Complete discission of the lens by the V-shaped method**) in operating for cataracts, plunges his needle directly through the lens into the vitreous, using his method for discission of the capsule by making two incisions in a V-shape. He believes that the danger of glaucoma from the too rapid swelling of the lens substance is prevented because the pressure on the iris angle is relieved through the opening in the posterior capsule. Only one operation is necessary and the absorption goes on with much greater rapidity than with the usual procedure, being usually complete within a month.

ALLING.

XII.—GLAUCOMA.

81. GOERG. **The results of Elliot's operation for glaucoma.** *Diss. Giessen*, 1920.

82. HEINE. **Operative treatment of glaucoma.** *Klin. Monatsbl. f. Augenheilkunde*, lxv., p. 2.

83. LEHMANN. **Acute poisoning with atropine after instillation in a case of glaucoma simplex.** *Ibid.*, lxv., p. 112.

84. STIEREN, E. **Glaucoma after cataract extraction.** *American Journal of Ophthalmology*, June, 1921.

GOERG (81, **Results of Elliot's operation**) gives the results in 22 cases of trephining, part of which had been under observation only a few weeks. Three cases were of hemorrhagic glaucoma; in one there was improvement of vision, in one the eye had to be enucleated on account of severe pain, in one the lens became opaque. In two cases of chronic glaucoma the vision improved, in two it remained the same, in three it became worse, in five the tension was reduced to normal. In three cases of simple glaucoma the vision was made worse, in two it was permanently improved, and in two there was a temporary improvement. No important effect was obtained in two cases of absolute glaucoma. One case of secondary glaucoma was temporarily improved. Subsequent complications were: Increase of lenticular opacities, usually preëxisting, in five cases; detachment of the retina in one; sympathetic inflammation in two; atrophy of the eyeball in two; late infections in three.

STIEREN (84, **Glaucoma after cataract extraction**) reports three cases, in two of which he did a trephine operation in order to relieve the tension. He believes these cases to be rare and explains the increased tension by supposing that the vitreous closes the spaces of Fontana although in some instances the condition is due to epithelial ingrowth which sometimes lines the whole anterior chamber. ALLING.

HEINE (82, **Operative treatment of glaucoma**) thinks trephining the most dangerous of all interventions for glaucoma. The object of an operation is to secure the most perfect result possible by the slightest possible and least dangerous procedure. In acute glaucoma this is usually attained by iridectomy, and trephining is superfluous. Cyclodialysis may be employed in case of recurrence. In over a thousand cyclodialyses he has never seen an infection. The indication is not simply to reduce the tension, but to preserve the functions of the eye in their widest sense, vision, field, color sense, and light sense. If loss of function cannot be prevented by miotics, operation is necessary. Cyclodialysis is far less dangerous than iridectomy or trephining, because of the absence of danger of injury by the operation itself, and because of the absence of the danger of late infection. In simple glaucoma it is superior to iridectomy, and in prodromal stages it should be tried first.

LEHMANN (83, **Acute poisoning with atropine after instillation in a case of simple glaucoma**) reports the case of a man 47 years old who had been under treatment with pilocarpine and eserine a number of years for glaucoma and was suddenly seized with convulsions, paretic symptoms, and loss of consciousness. The pupils were moderately dilated and immobile, a condition which led to the suspicion that atropine had been substituted in his eye drops. This was found to be the fact. For four days he had instilled atropine three times a day instead of pilocarpine. The first attack appeared shortly after the first instillation. The tension of the eye had risen from *20mm* to *60mm*. This rise persisted for a week after the drug had been changed back, and reduction was not complete until the end of the third week.

XIII.—RETINA AND OPTIC NERVE.

85. BLAGVAD and RÖNNE. **Retrobulbar neuritis.** *Klin. Monatsbl. f. Augenheilkunde*, August-September, 1920, p. 206.

86. BRUNER, A. B. **Spasm of the central retinal artery.** *American Journal of Ophthalmology*, July, 1921.

87. CLAUSEN. **Angiomatosis retinæ.** *Klin. Monatsbl. f. Augenheilkunde*, August-September, 1920, p. 413.

88. DEUTSCHMANN, R. **A peculiar, probably congenital macular change.** *Archiv f. Ophthalmologie*, cii., p. 1.

89. ERGGELET. **Angiomatosis retinæ.** *Klin. Monatsbl. f. Augenheilkunde*, August-September, 1920.

90. GILBERT. **Anatomy of changes in the myopic fundus.** *Archiv f. Augenheilkunde*, lxxxvi., p. 282.

91. GOURFEIN-WELT. **The relation of retinitis exudativa to angiomatosis retinæ.** *Klin. Monatsbl. f. Augenheilkunde*, July, 1920, p. 105.

92. GRISCOM, J. M. **Hereditary optic atrophy.** *American Journal of Ophthalmology*, May, 1921.

93. GUIST. **Angioid streaks.** *Zeitschr. f. Augenheilk.*, xlvi., p. 217.

94. LAMB, R. S. **Treatment of detached retina,** *American Journal of Ophthalmology*, September, 1921.

95. MEINSHAUSEN. **Pathological condition in a fresh case of embolism of the central artery of the retina.** *Klin. Monatsbl. f. Augenheilkunde*, August-September, 1920, p. 199.

96. MELLER. **Relation of retrobulbar neuritis to the nasal cavity ætiologically and therapeutically.** *Zeitschr. f. Augenheilk.*, xliv., p. 191.

97. SMITH, HENRY. **Night blindness.** *Journal A. M. A.*, October 1, 1921.

BRUNER (86, **Spasm of the central retinal artery**) describes the case of a man, aged 34, who came to him suffering from

attacks of blindness in the left eye which began suddenly and lasted for a few minutes and then gradually disappeared. The attacks occurred as often as ten times a day. During an attack the fundus showed the nerve and retina decidedly pale, arteries markedly contracted and the veins with the blood current stopped and broken into short columns. After about two weeks the patient had no further trouble.

ALLING.

MEINSHAUSEN'S (95, **Pathological condition in a fresh case of embolus of the central artery of the retina**) patient died three days after the embolism occurred. Autopsy revealed thrombi in the right ventricle, an open foramen ovale, and infarcts in the lungs, kidneys, and retina. Degenerative changes were present in the inner layers of the retina, distinct in the internal granular layer, of less degree in the layer of ganglion cells. The principal changes, œdematous, were seated in the fifth or intermediate granular layer, which is supplied by the choriocapillaris. This isolated œdema came from the choriocapillaris, and so is explainable as a collateral œdema in spite of the complete occlusion of the central artery. The engorgement found in the posterior choroidal vessels, with a simultaneous accumulation of leucocytes, is considered a collateral hyperæmia with accompanying chemotaxis.

CLAUSEN (87, **Angiomatosis retinæ**) describes the ophthalmoscopic picture seen in a woman 39 years old with typical angiomatosis retinæ. At one place was an exudation into the retina as in Coats' disease. A plexus of blood vessels lay on top of the exudation, and about the margins were proliferations of glia.

ERGGELET (89, **Angiomatosis retinæ**) reports a bilateral case. The X-rays were unable to check the advance. Iridectomy was performed in one eye on account of glaucoma. The other eye, in which cataract and painful glaucomatous condition had developed, was enucleated. The expected vascularity of the nodules in the retina was not present, the picture rather resembled that of exudative retinitis.

GOURFEIN-WELT (91; **Relation of retinitis exudativa to angiomatosis retinæ**) gives the findings in an eye enucleated from a boy 16 years old on account of hemorrhages and irido-

cyclitis. Prior to enucleation the ophthalmoscopic picture was typical of Coats' exudative retinitis. In the region of the macula of the other eye was a small red spot which was connected with a little looped vessel. The enucleated eye contained an angioma. The writer thinks that in most cases Coats' disease is the final state of an angiomatosis.

GILBERT (90, **Anatomy of changes in the myopic fundus**) describes his findings in eight myopic eyes. He mentions ruptures of the choroid into which the retina had been drawn and was either adherent, or incarcerated like a hernia. The choroid was infiltrated in the neighborhood of these places. As regards the formation of conus, he says that he found the folds of nerve fibers described by Heine three times, but doubts their importance in the genesis of conus, which he thinks is more probably due to an atrophy of the choroid.

In a woman 45 years old GUIST (93, **Angioid streaks**) found in each macula a retinitic spot with crescentic atrophies of the choroid temporally from the papilla. In both eyes were broad, brown pigment stripes arranged in a radiating manner; bebetween these were finer superficial stripes, some branching, some punctate. In red free light these stripes looked gray, showing that they were not hemorrhages as these look black in red free light. In the same light the retina presented the usual greenish reflex with here and there a radiating direction of fibers. Over the pigment striæ this uniform green shimmer was as if teased out; the fiber structure was vertical to the pigment stripes. The pigment ring usually found about the papilla was absent. This recalls the case like this reported by Pagenstecher in which Koehne found 17 years later that a circumpapillary ring had developed.

DEUTSCHMANN (88, **Peculiar change in the macula**) has observed a peculiar change in the macula in four cases, bilateral in one, monolateral in three. In the macula was a blue or a white spot surrounded by a red zone, which in turn was surrounded by whitish, atrophic spots separated by pigment radii, so that the entire figure resembled a wheel. Although the possibility of an interuterine inflammation was not excluded, Deutschmann thinks the condition due to a developmental fault as other developmental faults were present.

LAMB (94, **Treatment of detached retina**) by his treatment

tries to change the character of the fluid coming through the eye to remove if possible the fluid behind the detachment and to increase the intraocular tension that the retina might be held in place if reattached. To accomplish these objects the Murphy drip containing 10 grams of sodium carbonate and 20 grams of sodium chloride was employed, secondly, cyanide of Hg was injected subconjunctivally and thirdly, the thyroid extract was used until symptoms of over secretion appeared. He relates three cases in which the results seemed to be moderately satisfactory. ALLING.

SMITH (97, **Night blindness**) says that idiopathic night blindness is common in India, the disease being generally called retinitis pigmentosa but without pigment. He has rarely seen the pigmented variety in India. The atrophy slowly and steadily progressed until the patient is blind. The field of vision contracts *pari passu* with the advance of the disease. The reaction of the pupil also becomes progressively sluggish. Bearing these facts in mind the detection of malingering is easy. ALLING.

GRISCOM (92, **Hereditary optic atrophy**) reports fourteen cases in three generations of a family of thirty-three individuals. Aside from the optic atrophy the most constant feature was a low grade retinal degeneration. He believes that the family suffered from toxemia perhaps due to some type of perverted secretion. ALLING.

BLAGVAD and RÖNNE (85, **Retrobulbar neuritis**) discuss three forms of this affection, diabetes amblyopia, tobacco-alcohol amblyopia, and Leber's hereditary neuritis. Common characteristics of these are the almost constant bilaterality, and the overwhelming preponderance of occurrence among men rather than women. An accurate differential diagnosis must be made between Leber's disease and tobacco-alcohol amblyopia. Idiopathic cases, in which heredity is not demonstrable, prove to belong to this group through the stationary condition and through the much greater impairment of vision. A tabulated comparison of the idiopathic cases with those known to be hereditary shows a marked uniformity as regards age and severity of the visual disturbance which contrasts with the amblyopia induced by tobacco and alcohol. Leber's

disease is most apt to occur in the third decade of life, tobacco-alcohol amblyopia in the fifth and sixth decades; in the former disease vision is reduced to counting fingers at 3*m* up to $\frac{6}{60}$, in the latter usually to about $\frac{6}{24}$. In Denmark during the war a marked change appeared in the tobacco-alcohol amblyopia, the highest frequency appeared in the fourth and fifth decades of life, and the vision was usually reduced to counting fingers at 3*m*. The cause appears to lie in the prohibition of spirituous liquors and the drinking of substitutes, including denatured spirits. Investigation has shown that the addition of fusel oil is productive of a much greater toxic effect.

MELLER (96, **Relation of retrobulbar neuritis to the nasal cavity**) deals only with those affections of the eye in which scotoma is the only ocular symptom. If the therapeutic evacuation of an empyema of the ethmoid is successful, the importance of the accessory sinus disease is not to be denied even though multiple sclerosis should appear later. Markbreiter found changes in the visual fields in seventy per cent. of all such empyemata, hence it is not the papillomacular bundle alone which is affected. When there is no empyema and the ætiology is obscure, there should be no hesitation about intervening in the nose, because attention to disease of the mucous membrane, or enlargements of the turbinates, may be of unquestionable benefit. A good primary result followed by deterioration, with the nasal condition negative, does not necessarily prove that the cause was not rhinogenous; the transient improvement in such cases may have been due to the exclusion of certain circulatory and toxic troubles, while the changes in the papillomacular bundle may have gone too far and so result in final destruction.

XIV.—INJURIES AND FOREIGN BODIES.

98. ALEXANDER. **Bilateral rupture of the sclera.** *Münch. med. Wochenschr.*, XXXV., p. 1027.

99. LANDOLT, M. **Self-inflicted eye injuries.** *American Journal of Ophthalmology*, May, 1921.

100. PATTON, J. M. **Foreign body impacted in the sclera and retina loosened under direct observation with ophthalmoscope and removed.** *Ibid.*, June, 1921.

101. VOGT. **Prolapse of the vitreous into the anterior chamber after contusion.** *Klin. Monatsbl. f. Augenheilkunde*, July, 1920, p. 102.

ALEXANDER (98, **Bilateral rupture of the sclera**) reports a curious case, met with in a demented woman. One eye had been gored by a cow, and yet had a normal fundus and good vision with a correcting glass. The sclera of her other eye had been ruptured subconjunctivally by a blow, and, after absorption of the resultant hemorrhages, retained good vision.

LANDOLT (99, **Self-inflicted eye injuries**) after referring to the literature of traumatic conjunctivitis produced by the application of such irritants as soap, tobacco ash, and castor bean, recites the case of a young man, who, in order to escape military service on two different occasions, punctured the sclera in the ciliary region with a penknife. Both wounds healed without trouble.

ALLING.

PATTON (100, **Foreign body in the sclera and retina loosened under direct observation and removed**) discovered a piece of steel a short distance from the nerve-head imbedded in the retina in a patient who had been injured about three months before. After repeated attempts to extract it with the magnet, he introduced a knife needle and dislodged the steel while viewing the fundus with an ophthalmoscope. The splinter was then easily brought into the anterior chamber and then removed. He knows of but one similar successful case reported by Haab.

ALLING.

VOGT (101, **Prolapse of the vitreous into the anterior chamber after contusion**) reports two cases in which the lens and iris remained in their normal positions and there were only slight lacerations of the sphincter. Where the prolapse entered the anterior chamber the iris was lifted up a little from the anterior capsule. In the prolapse could be seen blood, which became absorbed more slowly than a hemorrhage into the anterior chamber, and some stains of pigment. A hyaloid membrane could be detected only through the difference of index. There was no increase of tension in either case.